Draft Environmental Impact Statement for the Montanore Project

Volume II

Chapter 3: Affected Environment and Environmental Consequences, Section 3.10, Ground Water Hydrology through Section 3.25, Other Required Disclosures

Chapter 4: Consultation and Coordination

Other Chapters: Index, Acronyms, Glossary, and References

Cabinet Mountains *Photo by M. Holdeman*

USDA

United States Department of Agriculture
Forest Service
Northern Region

Kootenai National Forest

Montana Department of Environmental Quality

3.10 Ground Water Hydrology

Ground water occurs in fractures of the bedrock formations beneath the analysis area and in unconsolidated glacial and alluvial sediments along and adjacent to drainages throughout the analysis area. Although hydraulically connected in many areas, the two water-bearing materials behave differently because of their respective hydraulic characteristics.

3.10.1 Regulatory Framework

3.10.1.1 Permits and Authorizations Held by MMC

Noranda submitted a "Petition for Change in Quality of Ambient Waters" in 1989 to the BHES requesting an increase in the concentration of select constituents in surface and ground water above ambient water quality, as required by Montana's 1971 nondegradation statute. Supplemental information to support the petition was submitted by Noranda in 1992. In response to Noranda's petition, the BHES issued an order in 1992, authorizing degradation and establishing nondegradation limits in surface and ground water adjacent to the Montanore Project for discharges from the project (BHES 1992). The Order established numeric nondegradation limits for total dissolved solids, chromium, copper, iron, manganese, zinc in both surface and ground water, nitrate (ground water only), and total inorganic nitrogen (surface water only) (Table 79; Appendix A). These nondegradation limits are discussed in section 3.10.1.2.2, *Nondegradation Regulations*. The Order remains in effect for the operational life of the project and for as long as necessary thereafter. The Order also indicates that treatment using land application and disposal as then proposed, and currently proposed in Alternative 2, would satisfy the requirement in ARM 16.20.631 (3) (now ARM 17.30.635 (3)) to treat industrial wastewaters using technology that is the best practicable control technology available, or, if such technology has not been determined by the EPA, then the equivalent of secondary treatment as determined by the DEQ. In 1992, the DHES (now DEQ) determined that land application and disposal treatment, with at least 80 percent removal of nitrogen, would satisfy the requirements of ARM 16.20.631(3). The Order requires the DEQ to review design criteria and final engineering plans to determine that at least 80 percent removal of nitrogen would be achieved. The Order also adopted the modifications developed in Alternative 3, Option C, of the Final EIS (1992), addressing surface and ground water monitoring, fish tissue analysis, and in-stream biological monitoring.

3.10.1.2 Applicable Regulations and Standards

3.10.1.2.1 State Standards

Montana's water quality rules classify all ground waters in the analysis area as Class I, which are suitable with little or no treatment for public and private drinking water supplies, culinary, and food preparation purposes, irrigation, drinking water for livestock and wildlife, and commercial and industrial purposes. Montana water quality standards for inorganic pollutants pertinent to the project are shown in Table 79.

3.10.1.2.2 Nondegradation Regulations

The Montana Water Quality Act requires the DEQ to protect high quality state water from degradation. The current nondegradation rules were adopted in 1994 and apply to any activity resulting from a new or increased source that may degrade a high quality water. These rules do

not apply to sources, such as the Montanore Project, that received an authorization to degrade prior to the adoption of the 1993 amendments to Montana's nondegradation statute.

Table 79. Nondegradation Limits Established by BHES Order for the Montanore Project and Montana Surface Water Quality Standards.

Parameter	BHES Order Maximum Allowable Nondegradation Limits (mg/L)	Montana Ground Water Quality Standards (mg/L)
pH		6.5– 8.5
Total dissolved solids	200	—
Nitrate + nitrite, as N	10	10
Dissolved Metals		
Antimony	—	0.006
Arsenic	—	0.01
Cadmium	—	0.005
Chromium	0.02	0.1
Copper	0.1	1.3
Iron	0.2	—†
Lead	—	0.015
Manganese	0.05	—†
Mercury	—	0.002
Nickel	—	0.1
Selenium	—	0.05
Silver	—	0.1
Zinc	0.1	2

"—" = No applicable concentration.
mg/L = milligrams per liter.
†The concentration of iron or manganese must not reach concentrations that interfere with the uses specified in the surface and ground water standards (ARM 17.30.601 *et seq.* and 17.30.1001 *et seq.*). The Secondary Maximum Contaminant Level of 0.3 mg/L for iron and 0.05 mg/L which is based on aesthetic properties such as taste, odor, and staining, may be considered as guidance to determine the levels that will interfere with the specified uses.
Source: BHES Order 1992 (Appendix A), Circular DEQ-7, Montana Numeric Water Quality Standards, DEQ 2008.

3.10.2 Analysis Area and Methods

3.10.2.1 Analysis Area

The ground water analysis area includes all areas around the proposed mine facilities: mine, adits, LAD Areas, and tailings impoundment sites. The transmission line would not affect ground water and is not discussed further in this section. The analysis area (model domain) for a ground water model developed by the lead agencies includes a large area around the facilities, bounded by U.S. 2 to the east, Bull River and Clark Fork River on the west and southwest, Big Cherry Creek to the north, and Silver Butte Fisher River to the southeast. The model domain is depicted in Figure 69.

3.10.2.2 Baseline Data Collection

Ground water data from monitoring wells in the Little Cherry Creek and Poorman Tailings Impoundment Sites, and LAD Areas, and adit portal areas were collected annually between 1988 and 1995 (Geomatrix 2006c). The sampling frequency varied from one to multiple times per year.

Limited bedrock ground water data were collected in the area overlying the ore body during an exploration drilling program in the 1980s. Exploration data included notations of observations of ground water in core holes and depth to water in those core holes that encountered ground water. Additional bedrock ground water data were collected by Noranda between 1990 and 1998 prior to sealing of the Libby Adit. The adit data included water discharge records, detailed descriptions of fractures and faults encountered by the adit, and ground water quality (Geomatrix 2006c).

Considerable ground water data were collected in the Little Cherry Creek Tailings Impoundment Site, including distribution of ground water heads, aquifer characteristics of the various hydrostratigraphic units, and water quality (Geomatrix 2006c). Several monitoring wells and boreholes were installed in the area of the Poorman Tailings Impoundment Site in 1988 (Chen-Northern 1989). The wells and boreholes were used to define ground water flow direction and subsurface geology and one well was tested to determine hydraulic conductivity. This information was supplemented with a resistivity survey. Water samples were collected from wells in the Poorman Tailings Impoundment Site between 1988 and 1993 and analyzed for most major cations and anions and total dissolved solids.

Validation ground water quality data were collected by MMC from two monitoring wells installed in 2005, one in the Little Cherry Creek Tailings Impoundment Site and one near the proposed LAD Areas (Geomatrix 2006c).

With the exception of the validation sample results, all of the ground water hydrology data were collected prior to 2003. The data are basic information and are representative of current conditions. There may be slight changes in depth to ground water due to seasonality or longer climate cycles, but the basic ground water flow directions have not changed. The aquifer characteristics measured in the 1980s and 1990s would not change within the timeframe of the project. Ground water quality may vary slightly, but validation samples collected from two locations by MMC in 2005 confirmed that ground water quality has not changed appreciably.

3.10.2.3 Impact Analysis

3.10.2.3.1 Montanore Mine Area Hydrology

Because ground water hydrology data from the proposed mine area are limited, the agencies used a numerical ground water model to evaluate various aspects of proposed conceptual models to define a consistent conceptual model that could be used to evaluate potential impacts to the mine area ground water hydrology. A complete description of the model, including assumptions, results, and calibration is provided in the Hydrogeology Technical Report (ERO Resources Corp. 2008b).

A hydrogeology committee consisting of representatives from the KNF, DEQ, MMC, and ERO was established to guide the development of the agencies' numerical model. The agencies' conceptual model was modified as the numerical analysis progressed, as described below. The agencies' numerical model was initially constructed using the following assumptions regarding a conceptual model for the Montanore mine area:

- Metasedimentary rocks in the mine area have very low primary permeability (hydraulic conductivity).
- Fractures and other structures provide pathways for ground water movement.
- Fracture or secondary permeability is higher than primary permeability.
- Source of ground water is infiltration of precipitation.
- Static water levels measured in exploratory boreholes (in those containing water) were at an elevation of about 5,400 to 5,600 feet.
- Springs consistently start at an elevation of about 5,400 to 5,600 feet. Springs that occur above this elevation are probably the result of isolated shallow flow cells controlled by local fracturing, bedding planes, or drainage from surficial material such as colluvium or talus.
- Base flow to streams and springs is maintained by ground water discharge. Perennial flow in area streams begins at an elevation of about 5,400 to 5,600 feet. (Base flow is the flow of a perennially flowing stream without any direct surface water runoff; such flow is the result of ground water seepage into the stream channel. During the driest portions of the year when there is no surface runoff either from snowmelt or rain, the only flow in a perennial stream is base flow.)
- A ground water table exists at depths up to 500 feet below ground surface in the higher topographic areas and is at or near land surface in areas below elevations of 5,400 to 5,600 feet.

For the mine area, the hydrologic data used to calibrate the model were:

- Empirical information concerning elevation of springs and the start of perennial streamflow (at an elevation of 5,400 to 5,600 feet) (USGS 1983; Wegner, pers. comm. 2006b)
- Measured flow from the Libby Adit (steady state flow of 150 gpm) (Geomatrix 2006a)
- Steady state flow from the Heidelberg Adit in the East Fork Rock Creek drainage (Figure C-2 in Appendix C) (45 to 135 gpm) (it is assumed that 45 gpm represents base flow to the adit and the higher flows represent periods of increased shallow ground water flow) (Gurrieri 2001)
- Measured base flows in streams at the edges of the model domain

Because there were insufficient site data to support a three-dimensional model, the agencies used a two-dimensional model to perform the analysis. Although the numerical precision of this two-dimensional model is limited by the relatively small amount of field data available for calibration, the model was configured to take advantage of the availability of a wide range of observation and measurement types (including streamflow data, location of perennial springs, and limited ground water information from exploration boreholes). In addition to calibrating the agencies' numerical model, the predicted base flow in East Fork Rock Creek was compared to observed streamflow in September 2007. The field comparison indicated that the model-predicted values for base flow in the upper reach of East Fork Rock Creek were similar to observed streamflow during a period of base flow.

The inherent uncertainties in the agencies' numerical model are not sufficiently large to preclude the model's ability to predict reasonable values of base flow and changes to base flow under mine dewatering conditions. The uncertainties prevent the agencies' numerical model from predicting exactly where ground water drawdown and the resulting decrease in base flow would occur. Most of the uncertainties in the agencies' numerical model are due to the model's inability to simulate the heterogeneous conditions of the fractured system. The likely location of reduced base flow can be deduced where there is sufficient field information concerning the location of bedrock springs and saturated fractures.

The two-dimensional model does not permit the inclusion of detailed geologic layers. As such, ground water within surficial material along the streams, such as alluvium, colluvium, and glacial deposits, cannot be directly simulated. The numerical model simulated the likely contribution of the surficial deposits to base flow by using varying infiltration rates (as a function of slope). During the agencies' field review of upper East Fork Rock Creek in September 2007, very little surficial material was observed at the higher, steeper elevations. The surficial material observed at the higher elevations is relatively thin. As a result, it is unlikely that this material can store significant volumes of ground water for discharge to streams during late summer/early fall when base flow is the primary contributor to streamflow (Gurrieri, pers. comm. 2007; MMC 2006). This specific condition was observed during the September 2007 field review. In the lower elevation areas, surficial material can be hundreds of feet thick and likely contributes ground water to streams late in the season.

Although the model does not simulate ground water in thick sequences of surficial material, the selection of infiltration rates to match measured base flows indirectly accomplishes the simulation. The higher infiltration rate used for lower elevations probably compensates for the higher permeability material not directly included in the model. If the lower elevations were only composed of bedrock, the infiltration rate would be lower and the base flow also would be lower. To calibrate with measured base flows, the infiltration rate had to be increased in these areas.

The area of study (model domain) is based on the maximum area potentially affected by mine-induced changes in the ground water hydrology, as determined by the agencies' numerical ground water model. The two tailings impoundment sites and LAD Areas are included within the model domain, but were not specifically modeled with respect to their proposed operation in the mine-area two-dimensional model. Three scenarios were modeled: pre-mining, mining, and post-mining conditions.

3.10.2.3.2 Little Cherry Creek Tailings Impoundment Hydrology

MMC developed a ground water model of the Little Cherry Creek watershed using the two-dimensional finite element program Seep/W (Klohn Crippen 2005). The Seep/W program models mounding of the ground water beneath water retention structures such as tailings impoundments and changes in pore-water conditions within earth slopes due to infiltration. The agencies independently performed SEEP/W analyses, using the same geologic and hydrologic model developed by MMC (USDA Forest Service 2008a). The ground water model assumed four stratigraphic units:

- An upper glaciolacustrine layer with the lowest in-situ hydraulic conductivity (0.01 ft/day) that was not continuous in lateral extent

- A lower glacial till layer that was also not continuous in lateral extent and had higher hydraulic conductivity (0.1 ft/day) than the overlying glaciolacustrine layer but lower than the underlying fractured bedrock
- A fractured bedrock layer with the highest relative hydraulic conductivity (0.3 ft/day) that was assumed to be the primary aquifer in the Little Cherry Creek drainage
- A less fractured, hard bedrock stratum with very low hydraulic conductivity (0.03 ft/day)

The agencies and MMC both used the same hydrologic and geologic boundary conditions, which assumed a constant precipitation infiltration of 0.26 feet/year, basin elevations of 4,750 feet at the head of the watershed, 3,110 feet at the confluence of Little Cherry Creek and Libby Creek, and constant head at the surface of the tailings. Neither MMC's nor the agencies' modeling incorporated a pumpback well system, which likely would be necessary to intercept seepage not captured by the underdrain system.

Analyses were performed assuming a baseline or predevelopment condition, and then assuming various tailings elevations within the tailings dam throughout the life of the project. Tailings elevation ranged from 3,500 feet (top of the starter dam) to elevation 3,700 feet (maximum tailings elevation). The agencies performed analyses at various elevations to determine if different tailings elevations affected seepage rates. Analyses also were performed at the final tailings elevation of 3,700 feet to estimate the effects of drain under the tailings dam on seepage, and then the effects of drains under both the tailings and the tailings dam, as proposed by MMC.

3.10.2.3.3 Ground Water Quality

Potential changes in ground water quality were assessed by developing estimates of expected wastewater quality that would be discharged to ground water, such as seepage from an impoundment and water applied to the LAD Areas. Mass balance calculations were performed at the impoundment sites and LAD Areas, mixing the applied water with the existing or ambient conditions, including ground water flux and ground water quality to estimate the likely final ground water quality. The agencies' approach to the mass balance calculation, the expected wastewater quality, and the uncertainties associated with the mass balance calculations are discussed in section 3.11.2, *Analysis Area and Methods* in section 3.11, *Surface Water Hydrology*. Ambient concentrations used in the analysis are representative of the concentrations found at each assessed area: the Little Cherry Creek Impoundment Site, the Poorman Impoundment Site, and the LAD Areas (Table 81 in section 3.10.3.5, *Ground Water Quality*). No data were available for antimony in the Poorman Impoundment Site; antimony concentrations from the Little Cherry Creek Impoundment Site were used in the Alternative 3 analysis. For the mine area water quality analysis, hydrologic principles were used to evaluate likely changes to ground water quality as a result of dewatering the mine void and adits.

3.10.3 Affected Environment

3.10.3.1 Bedrock Hydrogeology

3.10.3.1.1 Hydrogeologic Framework

Bedrock in the mine area consists of metamorphosed sediments known as the Belt Supergroup. The sediments were originally deposited as a series of muds, silts, and sands, subsequently metamorphosed to argillites, siltites, and quartzites, respectively. The primary porosity and

permeability of the bedrock is very low, as a result of the metamorphic process. The primary hydraulic conductivity may be as low as 10^{-11} cm/sec (2.8×10^{-8} ft/day) with virtually zero primary effective porosity. All bedrock units are fractured and faulted to various degrees, depending on proximity to large fault structures and depth. Fractures and faults result in secondary hydraulic conductivity and secondary porosity values that are much higher than primary hydraulic conductivity values. Secondary hydraulic conductivity may range from 10^{-4} to 10^{-6} cm/sec (0.0028 to 0.28 ft/day) (Gurrieri 2001). Various estimates of the bulk hydraulic conductivity (which considers both the primary and secondary hydraulic conductivities) have been made (Gurrieri 2001; Klohn Crippen 2005; Geomatrix 2006c). The agencies' numerical model of the site hydrogeology was calibrated using a bulk or average hydraulic conductivity of the bedrock in the mine area of about 10^{-7} cm/sec (ERO Resources Corp. 2008b).

The Rock Lake Fault bounds the western side of the mine area and extends northwest and southeast through the mine area. The fault is a major structure with as much as 1,500 to 2,000 feet of vertical displacement (USGS 1981). The agencies' numerical ground water model was used to explore the fault's role in the site area hydrogeology. Based on the model results, the average or bulk hydraulic conductivity of the fault zone is estimated to be slightly higher than that of the bedrock (2.5×10^{-5} cm/sec (7×10^{-2} ft/day)) (ERO Resources Corp. 2008b). The fault zone may contain zones or fractures with higher hydraulic conductivities. The model results indicate that if these zones exist, they are not horizontally extensive because the fault zone does not appear to play a major role in the regional hydrogeology.

The hydraulic conductivity of fractures and joints tends to decrease with depth, due to confining pressures of the rock reducing the fracture apertures (Snow 1968). In brittle crystalline rock (such as the Belt Supergroup); however, fracture apertures can be maintained to considerable depths, as evidenced by inflows during the construction of the Libby Adit and by reports of ground water inflows from numerous deep hardrock mines around the world. This is particularly true when fractures are associated with large structures, such as the Rock Lake Fault (Galloway 1977).

The geologic logs of exploration boreholes drilled into the mine area indicate that a thin layer of highly weathered bedrock or overburden (such as colluvium) exists over much of the higher topographic areas. This layer ranges in thickness from 0 to 50 feet and averages 36 feet thick.

As is typical for mountainous areas, the ground water table generally follows topography. A water level contour map for the mine area cannot be constructed because water level data were limited. Available data and observations suggest a water table exists within much of the mine area. For example, the depth to water was measured in a few of the exploration boreholes (HR-19 and HR-26) with a consistent water surface elevation of about 5,400 to 5,600 feet (Chen-Northern 1989). The depth to water in exploration boreholes adjacent to Rock Lake (HR-7, 8, 9, and 10) and St. Paul Lake (HR-29) was the same elevation as the lake (Chen-Northern 1989). Several borehole logs did not report a depth to ground water or report encountering ground water. Based on observation, springs and perennial portions of streams generally start at elevations of 5,400 to 5,600 feet (USGS 1983; Wegner, pers. comm. 2006b). The depth to water measurements and site observations indicate that a water table exists at a depth of about 500 feet below land surface in the higher areas, and near or at the surface in areas below an elevation of about 5,400 to 5,600 feet. A September 2007 site review by the agencies located a perennial bedrock spring in the East Fork Rock Creek drainage at an elevation of 5,625 feet, slightly above the estimated range of 5,400 to 5,600 feet. This spring likely derives its flow from the fractured bedrock, based on the

geology and spring characteristics, and its elevation is considered to be within the estimated range for intersection of the water table with the ground surface.

3.10.3.1.2 Conceptual Model of the Mine-Area Bedrock Hydrogeology

A hydrogeologic conceptual model is a commonly used tool for extending knowledge beyond what is specifically known and allowing the predictions or estimates of what the hydrogeologic system's response might be if conditions change in the future. For a hydrogeologic conceptual model to be useful, it must be internally consistent and explain most, if not all, observations or known facts. A model that is not internally consistent cannot be confidently used to predict responses to changes in conditions. The following sections discuss two conceptual models of the site hydrogeology. The two models use the same basic geologic framework, but arrive at different conclusions regarding the hydraulic connection between deeper ground water, shallow ground water, and surface water.

MMC's Conceptual Model

MMC's conceptual model has ground water flow in the mine area divided into three general flow paths: (1) regional deep flow in bedrock; (2) local shallow flow in upper weathered and fractured bedrock; and (3) local shallow flow in surficial unconsolidated deposits (Geomatrix 2007c, 2007d). Ground water in these flow paths moves from higher to lower elevations. The deeper regional flow path is characterized by low hydraulic conductivity fractures, faults, and bedding planes that convey ground water from recharge areas at high elevations to areas of low elevation along the flanks of the Cabinet Range. Very little, if any, ground water moves through the unfractured rock matrix.

The shallow flow paths are characterized by localized recharge and discharge through near-surface fractured and weathered bedrock, fine-grained glacial lake beds (glaciolacustrine) of silt and clay, and poorly sorted glacial outwash deposits (glaciofluvial) of gravel, sand, silt, and clay. Shallow ground water also flows in alluvial deposits of sand and gravel that occur in many of the valleys of the Cabinet Range (Geomatrix 2006d).

The Cabinet Mountains are composed of hard, brittle metasedimentary rocks with complex fracture systems that can store and transport ground water (Geomatrix 2006c). Glacial deposits mantling the flanks of the mountains support shallow ground water systems. Valleys with streams draining the mountains contain unconsolidated colluvial and alluvial deposits that also support local ground water systems. In general, most ground water is recharged at higher elevations and moves downhill in both shallow and deep bedrock systems. The deep regional ground water moves down to the valleys where some of the water discharges to the glacial and valley fill deposits. Some of this water also discharges to streams and springs in the analysis area. MMC reports that most ground water in the deeper fractures discharges to surface flow systems below an elevation of about 4,000 feet and is not well connected hydraulically to lakes, streams, and springs above 4,000 feet near the proposed mine (Geomatrix 2007d, 2008e).

During mine development and the mining period, ground water would flow into the adits and mine void. The inflow rate of 1,200 gpm used by MMC for assessing storage and discharge requirements likely would be a maximum inflow rate that may occur during relatively short-term dewatering of fractures. Except for short-term elevated inflow rates from initial dewatering of fractures, the steady-state long-term inflow rates for the mine and adits are estimated to be 600 to 800 gpm (Geomatrix 2007c). For the post-operational period, ground water intercepted by the mine workings would fill the mine workings. MMC anticipates no long-term discharge would be

expected from the adits because the Libby Adit has had no discharge since 1998 and the adit would be plugged at closure. When the Libby Adit was reopened in 2006, ground water within the adit was observed to be discharging to colluvium exposed within the adit near the portal. The adit seepage probably flowed through the colluvium to the Libby Creek alluvium. MMC anticipates that there would be immeasurable impacts to base flow during mining or after because much of the water flowing into the mine void would be from storage, and the deeper ground water system is not well connected to surface water bodies near the proposed mine (Geomatrix 2007d, 2008e).

Agencies' Conceptual Model

The agencies' conceptual model is based on the following key components of the hydrogeologic framework:

- Metasedimentary rocks in the mine area have very low primary permeability (hydraulic conductivity)
- Fractures and other structures provide pathways for ground water movement
- Fractures or secondary permeability is higher than primary permeability

The source of all surface and ground water in the Cabinet Mountains is precipitation that falls within the mountain range. No regional aquifers beneath the range derive their source of water from outside the range. Ground water (shallow and deep) results from infiltration of precipitation at various rates, depending on the topography and geologic material exposed at the surface. Due to the topographic relief, occurrence of more permeable surficial geologic deposits and low overall hydraulic conductivity of the bedrock, different ground water flow paths have developed in shallow unconsolidated deposits and the deeper fractures of the bedrock. At the higher elevations (greater than about 5,600 feet), the surficial deposits are non-existent or relatively thin and discontinuous, but they store and discharge infiltrated precipitation over the course of a year. In typical or dry precipitation years, it is likely that all ground water drains from these deposits by the end of the season. In wetter years, ground water may not fully drain by the end of the season. The net infiltration rate to deeper fractures in the steeper bedrock terrain is probably very low, as most precipitation would leave the area as runoff. The shallower, more fractured or weathered portions of the bedrock probably receive and transmit water at higher rates than the deeper fractures.

The contrast between the very low hydraulic conductivity of the deeper fractured bedrock and the higher hydraulic conductivity of the shallow weathered bedrock/surficial deposits and infiltration rates between the shallow and deeper fractured bedrock (and surficial material) appears to result in two saturated zones with distinctly different flow characteristics. The shallow and deeper flow paths do not appear to be hydraulically connected above an elevation of about 5,600 feet. There is probably ground water leakage from the shallow weathered bedrock/surficial deposits at low rates into unsaturated bedrock or randomly saturated vertical fractures that eventually reaches the deeper fractured bedrock flow path. Site observations during the exploration program, elevation of where streams become perennial, and field observations concerning the location of springs indicate that a water table has developed in interconnected fractures at a depth of about 500 feet below the areas of highest elevation. The water table slopes toward the valleys and intersects the low areas at an elevation of about 5,400 to 5,600 feet, about the same elevation that streams become perennial (Figure 70). Springs exist above and below 5,400 to 5,600 feet elevation range; springs above this elevation are part of the shallow flow path and springs below this elevation are

connected to both flow systems. Below an elevation of between 5,400 and 5,600 feet, there are two distinct flow paths due to very different hydraulic conductivities, but the two flow paths are hydraulically connected.

Base flow, defined as the volume of flow in a stream channel that is not derived from surface runoff but rather from ground water seepage into the channel, is maintained in the upper reaches of each drainage by deeper bedrock fractures during the driest part of each year. In the middle and lower reaches of the drainages, it is difficult to separate that portion of the "apparent" base flow resulting from the deeper system versus from shallow ground water. In the lower, flatter areas, ground water from thicker surficial deposits accounts for a much higher contribution to base flow than in the higher areas. During the year, there is probably an ever-changing ratio between shallow ground water and deeper bedrock ground water contributions to any one stream, as the season progresses. Depending on when precipitation starts in the fall, it may not be possible to know if or when a stream reaches true base flow, particularly with the limited available flow data for streams in the analysis area.

The agencies' field review of the East Fork Rock Creek drainage during the driest season (September 2007) indicated that the only surface water flow in East Fork Rock Creek above Rock Lake was from discharge of ground water from bedrock springs. During the review, there was no surface water runoff or evidence that shallow springs maintained by snowmelt and/or recent rainfall contributed any water to the drainage. At least one small spring was flowing down a bedrock wall near St. Paul Pass; the source of the spring's water was probably a small snowfield high on Rock Peak. It appeared that the spring water was consumed by evapotranspiration and never reached the Rock Creek drainage. Precipitation records from the SNOTEL site near Bear Mountain, Idaho, indicate that the summer of 2007 had the second longest period (51 days) without precipitation since continuous precipitation data collection began in 1983. Bedrock springs from the Rock Lake fault zone along the East Fork Rock Creek drainage above Rock Lake accounted for 100 percent of the flow in the stream, which was estimated at 30 to 40 gpm. Ground water discharge to the stream started at an elevation of about 5,625 feet. At the time of the field review, bedrock ground water appeared to be the sole source of water to Rock Lake. Streamflow gradually increased downstream from an estimated 40 to 50 gpm below Rock Lake to an estimated 1 cfs (480 gpm) within 0.5 mile and 2 cfs before the stream enters Rock Creek Meadows. These observations are consistent with the agencies' conceptual model that deeper bedrock ground water is connected to shallow ground water and surface water at elevations below about 5,600 feet.

Of the two conceptual models (MMC's and agencies'), the agencies' conceptual model is the more conservative with respect to predicting potential impact to ground and surface water resources in the mine area. In addition, the agencies' conceptual model is better supported by site data and observations. Therefore, the remainder of this section uses only the agencies' conceptual model as the basis for discussion and analyses of the affected environment.

3.10.3.2 Valley-fill Hydrogeology

Ground water occurs in the valley-fill deposits in narrow mountain valleys. These deposits contain colluvial, alluvial, and glacial materials in a heterogeneous mixture of clay, silt, sand, and larger-sized particles. Valley-fill deposits follow the valley bottoms, are not extensive, and are discontinuous because bedrock crops out along the stream channel bottoms. Geophysical surveys indicate the valley-fill deposits are 30 to 70 feet thick at the Libby Adit Site, and 24 to 70 feet

thick at the Ramsey Plant Site. Ground water was encountered during drilling at depths of 12 to 16 feet at the Libby Adit Site and at 22 feet at the Ramsey Plant Site.

The valley-fill systems are recharged by precipitation, streamflow, and subsurface discharge from bedrock ground water systems. Ground water flow follows the topography down the valley bottoms. The valley-fill discharges to surface water or to more extensive glaciofluvial and glaciolacustrine deposits along the mountain front.

3.10.3.3 Glaciofluvial-glaciolacustrine Hydrogeology

In both tailings impoundment sites, the Libby Plant Site, and the LAD Areas, ground water occurs either as perched water, water table, or artesian conditions in unconsolidated glaciofluvial and glaciolacustrine deposits. The glacial deposits form a wedge along the eastern flank of the Cabinet Mountains, beginning at an elevation of about 4,000 feet and increasing in depth away from the mountains. The deposits range in thickness from zero at bedrock outcrops near the Little Cherry Creek Impoundment Site to over 200 feet thick in the Poorman Tailings Impoundment Site, based on apparent resistivity (Chen-Northern 1989).

The glaciofluvial and glaciolacustrine deposits are interfingered (a boundary that forms distinctive wedges, fingers or tongues between two different rock types) and, at many locations, glaciolacustrine deposits overlie glaciofluvial deposits. The glaciolacustrine deposits are finer-grained and act as a barrier to ground water flow. In the Little Cherry Creek Tailings Impoundment Site, a buried preglacial valley underlies the glaciolacustrine deposits. This valley is filled with over 275 feet of fluvial sediments similar to the glaciofluvial deposits.

The glaciofluvial/glaciolacustrine ground water system is recharged by precipitation, discharge from fractured bedrock, and streamflow along the flank of the mountains. Ground water flow in both potential impoundment sites is generally easterly following the surface topography (Figure 72). The potentiometric surface gradient (hydraulic gradient) is low in both the Little Cherry Creek and Poorman Tailings Impoundment Sites (0.05 and 0.07, respectively). Ground water flow in the Little Cherry Creek Tailings Impoundment Site is generally easterly following the surface topography, discharging to Little Cherry Creek and eventually to the alluvium of Libby Creek. Some flow may discharge to Libby Creek via the deep buried alluvial channel. Ground water beneath the Poorman Tailings Impoundment Site also flows easterly following topography and discharges to the alluvium of Libby Creek. A map showing ground water elevations is presented in Chen-Northern (1989), and includes areas of potential artesian flow beneath the right embankment of the proposed Little Cherry Creek Tailings Impoundment Main Dam. Some of the water flowing beneath the Little Cherry Creek Impoundment Site discharges as springs in the proposed dam site area and downstream along Little Cherry Creek. Springs also were found in the Poorman Tailings Impoundment Site (see section 3.10.3.4, *Springs and Adits*).

Ground water in the LAD Areas discharges to Ramsey, Poorman, or Libby creeks. Based on depth to ground water data and general hydrologic principles, ground water beneath the LAD Areas flows toward the three creeks (Ramsey, Poorman, and Libby) that border the LAD Areas. Of the wells established in the LAD Areas, one exhibited artesian heads above the ground surface. Based on the available ground water data, the hydraulic gradient in the LAD Areas is about 0.06.

Aquifer tests were conducted in the glaciofluvial deposits and in the filled channel in the tailings impoundment sites. The hydraulic conductivity of the glaciofluvial deposits in the Little Cherry

Creek watershed ranges from 1 x 10^{-6} to 1.9 x 10^{-3} cm/sec (0.0028 to 5.3 ft/day) (Geomatrix 2006c). Estimates of the hydraulic conductivity of channel fill (alluvium along Libby Creek) ranges from 0.053 to 0.18 cm/sec (150 to 500 ft/day) (Geomatrix 2006c). In the Poorman Tailings Impoundment Site, the hydraulic conductivity of the glaciofluvial deposits range from 1.3 x10^{-4} to 6.8 x 10^{-3} cm/sec (0.37 to 19.4 ft/day) and average 2.6 x 10^{-3} cm/sec (7.35 ft/day), based on six aquifer tests (Chen-Northern 1989).

The glaciofluvial deposits are capped by relatively impermeable glaciolacustrine units. These deposits allow hydraulic pressures to build and create the confined or artesian flow conditions observed in the Poorman and Little Cherry Creek Tailings Impoundment Sites. The water levels observed in monitoring wells at the tailings impoundment sites are quite variable, ranging from beneath the bedrock-soil contact to above the ground surface, indicating artesian conditions along the lower portions of the valleys. It is not known whether the low permeability fine-grained material in the Poorman Tailings Impoundment Site are the same glaciolacustrine type deposits found in the Little Cherry Creek drainage, but they appear to function in the same manner.

Hydraulic conductivities of the glaciolacustrine deposits in the Little Cherry Creek Tailings Impoundment Site range from 1 x 10^{-6} to 2.6 x 10^{-5} cm/sec (0.003 to 0.075 ft/day) (Geomatrix 2006c). Although saturated, the fine-grained glaciolacustrine deposits did not yield measurable water in the boreholes. No aquifer tests were performed on the fine-grained deposits in the Poorman Tailings Impoundment Site. The range of hydraulic conductivity values in this area is probably similar to those measured in the Little Cherry Creek drainage.

3.10.3.4 Springs and Adits

3.10.3.4.1 Mine Area Springs

Springs in the analysis area are located in the unconsolidated surface deposits left by glaciers or occur at surface expressions of fractures and faults. Numerous springs were identified in the analysis area by MMC (Geomatrix 2006a, 2006d, 2007f). Other nearby springs and seeps outside of the analysis area, but within the upper Ramsey and Libby creek watersheds, have not been surveyed (Wegner, pers. comm. 2006b). Five springs in the CMW were identified by MMC, two south of Rock Lake, two near the north end of Rock Lake, and one near St. Paul Pass (Figure 71, Table 80). These springs are relatively small, discharging less than 4 gpm. Other springs in the analysis area (Table 80) originating from colluvium or bedrock discharge at higher rates (4 to 50 gpm).

It is likely that there are unidentified springs that have not been inventoried due partly to the steep terrain, forest cover, and size of the area. Also, the agencies' September 2007 field review identified springs overlying the mine area not previously mapped (SP-31, Figure 71). The DEQ reported spring discharge in a drainage above St. Paul Lake (SP-32, Figure 71) along the trace of the Rock Lake fault at an elevation of about 5,400 feet, slightly lower than the spring observed in the East Fork Rock Creek drainage (McKay, pers. comm. 2007). During normal to dry years when winter snows have completely melted, deeper ground water discharge may be the only source of water to St. Paul Lake during late summer to early fall. Spring SP-32 has not been observed during the late summer so it is uncertain whether this spring contributes water to St. Paul Lake during the late summer season. Because St. Paul Lake is located on a relatively permeable glacial moraine, the lake is reported to be completely dry during extended periods of low or no precipitation. This indicates that either the lake drains at a faster rate than input from ground water or the lake does not receive ground water input during the late season.

Table 80. Spring Flow Measurements and Elevations.

Spring Name	Elevation (feet amsl)	Flow Rate (gpm)
Springs in Libby Creek Watershed		
SP-01	3,500	2-3
SP-02	3,320	1-2
SP-10	3,350	1
SP-11	3,370	0.5
SP-12	3,390	seep
SP-13	3,410	unknown
SP-14	3,350	0.2
SP-15	3,420	1.5-2
SP-17	3,560	0.5
SP-18	3,550	2
SP-19	3,950	9
SP-20	3,850	<1-4
SP-21	3,800	<3
SP-22	4,240	<3
SP-23	3,680	<5
SP-24	3,450	<3
SP-25	3,840	5
SP-26	3,320	0.5
SP-27	3,840	2
SP-28	3,500	4
SP-30	3,420	5
Springs in CMW		
SP-1R	4,900	1 (Oct) - 10 (July)
SP-2R	4,850	1 (Oct) - 10 (July)
SP-4R	6,490	5-20
SP-05/3R	4,200	5-30 (100 in summer 1999)
SP-16	4,600	40-50
SP-31	5,625	30-50 (Sept 2007)
SP-32	5,400	Unknown

amsl = above mean sea level.
gpm = gallons per minute.
Source: Geomatrix 2006a, 2006d, 2007f; McKay, pers. comm. 2007; September 2007 agencies' field review of Rock Lake area.

The source of water to springs in the analysis area is ground water from either fractured bedrock or from unconsolidated deposits. Based on the agencies' conceptual model and the results of the agencies' numerical model, springs at elevations greater than about 5,600 feet (or greater than 5,625 feet) overlying the ore body are most likely associated with a shallow ground water flow path in weathered bedrock, glacial or alluvial deposits, or shallow fractures or bedding planes. Spring flow from bedrock fractures connected to the deeper ground water flow path cannot be ruled out, but no direct data supports this possibility. Springs located below an elevation of about 5,600 feet are also the result of discharge from shallow weathered bedrock or glacial/alluvial deposits, but because the shallow and deeper flow paths are most likely hydraulically connected,

some component of the total spring flow may be from the deeper flow path. The ratio between deep and shallow ground water probably varies from spring to spring and may vary seasonally.

The existing spring inventory overlying the ore body did not identify the source of ground water associated with each particular spring. A field review during September 2007 indicated that spring SP-05/3R, uphill from the Heidleberg Adit in the East Fork Rock Creek drainage, most likely has a bedrock ground water source. There was insufficient thickness of surficial material above the spring to support an estimated discharge rate of 30 to 40 gpm during a period of little to no precipitation. A previously unidentified spring or a series of springs along East Fork Rock Creek above Rock Lake at an elevation of up to 5,625 feet produced a total flow of about 40 to 50 gpm from the fracture zone associated with the Rock Lake fault. There is insufficient thickness or extent of surficial material above the springs to account for this flow rate during a dry period. Also, the stream bed above the spring consisted of exposed bedrock (no alluvium) indicating that there was no surface water or shallow ground water contribution to the springs from higher elevations.

3.10.3.4.2 Impoundment/LAD Area Springs

Most identified springs in the Libby Creek watershed occur in the Little Cherry Creek and Bear Creek drainages, or the Poorman Tailings Impoundment Site between Little Cherry Creek and Poorman Creek. All of the identified springs have measured flows of less than 5 gpm, except for the spring near the Libby Adit that was measured at 9 gpm. Some of these springs cease flowing in mid- to late-summer. The following descriptions (from 1988 to 2007) correlate to springs shown on Figure 71 and Figure 72 (Table 80).

3.10.3.4.3 Adits

The 700-foot long Heidelberg Adit, located in the East Fork Rock Creek drainage below Rock Lake, discharges water to East Fork Rock Creek. During a geotechnical evaluation of the Heidelberg Adit (Morrison-Knudsen 1989b), ground water flow in the adit was estimated to be 80 gpm. Gurrieri (2001) reports adit flows ranging from 49 to 128 gpm. Discharge from the adit appears to vary seasonally, suggesting the flow may be a combination of shallow and deep ground water. The shallow ground water contribution to the adit is more responsive to seasonal changes in precipitation. During September 2007, the estimated flow from the adit was between 40 and 50 gpm.

3.10.3.5 Ground Water Quality

Ground water samples from monitoring wells in the tailings impoundment sites and LAD Areas show that existing ground water quality is a calcium bicarbonate or calcium-magnesium bicarbonate type with low total dissolved solids concentrations (averaging 125 mg/L in the LAD Area, 92.4 mg/L in the Little Cherry Creek Tailings Impoundment area, and 118 mg/L in the Poorman Tailings Impoundment area) and frequently non-detectable dissolved metals. Manganese, cadmium, chromium, and copper were the only metals consistently detected in ground water samples. The pH of the water is near neutral or slightly acidic in the various project areas (Table 81).

Table 81. Existing Median Ground Water Quality.

Parameter	LAD Area Wells			Little Cherry Creek Impoundment Area Wells			Libby Adit Area Wells			Poorman Impoundment Area Wells		
	Median Conc.	No. Samples	No. BDL	Median Conc.	No. Samples	No. BDL	Median Conc.	No. Samples	No. BDL	Median Conc.	No. Samples	No. BDL
Field Measurements and Physical Parameters												
Field Temperature (C)	8	45	0	8	51	0	8	114	0	8	18	0
Field pH (s.u.)	6.5	47	0	7.2	51	0	6.0	100	0	7.4	18	0
Lab SC (µmhos/cm)	81	51	0	179	51	0	58	99	0	185	18	0
Total dissolved solids	85	51	0	99	51	0	<44	105	3	102	18	0
Cations and Anions												
Alkalinity, Total as $CaCO_3$	40	51	0	87	51	0	5	109	0	94	18	0
Alkalinity, Bicarbonate as HCO_3	49	51	0	106	51	0	6	109	0	115	18	0
Chloride	<2	51	16	<1	51	29	<1	109	53	<1	18	10
Sulfate	<5	51	18	<4	51	21	<5	109	16	<2	18	9
Calcium	7	51	0	<19	51	1	<5	109	5	24	18	0
Magnesium	<3	51	3	7	51	0	<1	109	41	8	18	0
Potassium	<1	51	18	<1	51	18	<1	109	53	<1	18	7
Sodium	<6	51	4	5	51	0	<4	109	14	<2	18	3
Nutrients												
Nitrate + Nitrite, as N	<0.49	56	6	0.10	51	0	<2.20†	135	2	0.07	18	0
Dissolved Metals												
Antimony	<0.003	6	6	<0.003	6	6	NM	0	0	NM	0	0
Arsenic	<0.005	51	51	<0.005	51	50	<0.005	100	99	<0.005	18	17
Cadmium	<0.0002	51	30	<0.001	51	36	<0.001	103	81	<0.001	18	13
Chromium	<0.004	51	48	<0.02	51	45	<0.02	103	103	<0.02	18	18
Copper	<0.001	51	32	<0.01	51	44	<0.01	103	97	<0.01	18	18
Iron	<0.05	51	36	<0.05	51	39	<0.05	103	100	<0.05	18	15
Lead	<0.001	51	42	<0.01	51	50	<0.01	103	102	<0.01	18	17
Manganese	<0.04	51	21	<0.03	51	20	<0.02	103	86	<0.02	18	16
Mercury	<0.0002	51	49	<0.0002	51	48	<0.0002	103	80	<0.0002	18	14
Silver	<0.0002	51	51	<0.001	51	50	<0.001	103	102	<0.001	18	18
Zinc	<0.02	51	29	<0.02	51	38	<0.02	102	71	<0.02	18	14

Conc. = concentration; No. Samples = number of samples analyzed for particular parameter; No. BDL = number of analyzed samples with concentrations below the detection limit; detection limit varied between sample events and parameter; detection limit used in calculating median when reported concentration was below the detection limit
All values are in milligrams per liter (mg/L) unless noted in first column.
s.u. = standard units; µmhos/cm = micromhos/centimeter; C = Celsius; < = less than concentration shown; NM = analyte not measured.
†Nitrate concentrations at Libby Adit area wells affected by Noranda's discharges.
Source: Geomatrix 2007f.

Limited information is available on bedrock ground water quality. Noranda collected samples of inflow water from the Libby Adit and MMC collected an additional sample in 2006 (Geomatrix 2006c). Noranda sampled a bedrock spring (SP-16) near the Heidelberg Adit in 1989 and concentrations of all analytical parameters were very low, with all metals except molybdenum below the detection limit (Chen-Northern 1990).

3.10.3.6 Ground Water Use

No ground water users have been identified in the analysis area. Private land immediately downgradient of the Little Cherry Creek Tailings Impoundment Site in Alternatives 2 and 4 is owned by MMC. Private land immediately downgradient of LAD Area 2 in all alternatives and downgradient of the Poorman Impoundment Site in Alternative 3 is not owned by MMC.

3.10.4 Environmental Consequences

3.10.4.1 Alternative 1 – No Mine

The No Mine alternative would not change ground water levels or quality. Monitoring wells installed as part of the baseline monitoring would be removed and the area reclaimed. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Disturbances at the Libby Adit Site would remain until reclaimed in accordance with existing permits and approvals.

3.10.4.2 Alternative 2 – MMC's Proposed Mine

3.10.4.2.1 Mine Area

Ground Water Levels and Flow

In all action alternatives, the mine plan would include an underground mine and three adit declines. The mine void would be the same in all action alternatives. In Alternative 2, two adits would originate in the Ramsey Creek drainage, and the existing Libby Adit would be used for ventilation. The mine and adits would intersect saturated fractures and faults in the bedrock and, therefore, would produce ground water at various rates. The water, called mine and adit inflows, would be pumped from underground structures and used for processing the ore. Another ventilation adit that would reach the surface near Rock Lake was not specifically considered in the numerical model because any ground water drawdown resulting from the ventilation adit would be superseded by drawdown created by inflow to the mine void.

Possible environmental consequences to the hydrogeology due to Alternative 2 would be expressed in two ways: lowering of ground water levels and changes in base flow. The agencies' numerical model was used to approximate where and to what degree ground water drawdown could occur, and to estimate changes in base flow for drainages flowing from the area to be mined.

Drawdown – Mining Period

In the agencies' numerical model to simulate dewatering of the mine void, the water table overlying the mine void was lowered (1,000 meters or about 3,300 feet) to the elevation of the

mine void at full build out of the mine. This simplifying assumption is necessary because of the use of a two-dimensional numerical model. Using this assumption, drawdown due to mine dewatering is predicted to extend about 2 miles from the mine void in all directions, but along the trend of the proposed adits, drawdown created by the mine void would merge with drawdown created by the adits (Figure 73). Given uncertainties described in the technical report (ERO Resources Corp. 2008b), the model cannot precisely predict the final configuration of the drawdown cone around the mine, but the model does provide an indication of the catchment area required to supply the predicted 450 gpm to the mine and adits on a steady state basis. If steady state inflow to the mine were higher, a larger catchment would be required to supply that water at the calibrated infiltration rates and hydraulic conductivity. For example, if the steady state inflow were in the range of 800 gpm estimated by MMC (Geomatrix 2007c), the catchment area would be about two times larger than predicted by the agencies' numerical ground water model, using the assumptions inherent in the model.

An example of the uncertainty in the agencies' numerical model is the final shape of the drawdown cone, due to the assumption in the agencies' numerical model that homogeneous conditions exist in the mine area. As a result of this assumption, the numerical model essentially distributes potential impacts from mine dewatering evenly in all directions. The site conditions may vary and ground water drawdown may be subject to some degree of heterogeneity, causing more drawdown along structural trends and less drawdown in other directions. Data are insufficient for the model to predict heterogeneous drawdown. Another example of uncertainty is the location of the 3-foot (1-meter) drawdown contour (assumed to represent zero drawdown) presented in the various figures in this document. The specific shape of the 3-foot (1-meter) contour is subject to influence by the size and location of the various elements used in the agencies' numerical model. To some extent, model elements control the geometric shape of the contours. Given the approximate nature of the agencies' numerical model, the location of all contours, including the 3-foot (1-meter) contour, should be considered approximate.

For those areas where the fractured bedrock water table is currently some depth below ground surface (for all areas above 5,600 feet elevation), ground water drawdown, as predicted by the agencies' numerical model, would not have a direct effect on surface water occurring above this elevation. Because surface and ground water above 5,600 feet elevation appear not to be hydraulically connected, ground water drawdown would not result in decreases to surface water (streams, springs and lakes) in those areas. Infiltration of precipitation is controlled by the nature of the surface material and overall hydraulic conductivity and, therefore, the infiltration rate would not change in these areas as a result of a lower water table. It is possible that random fractures exist above elevations of 5,600 feet that are saturated between the fractured bedrock water table and the shallow ground water flow path, hydraulically connecting the two ground water flow paths. If this condition existed, drawdown of the fractured bedrock water table by mine dewatering could reduce flow to unidentified springs or affect lake levels associated with this type of fracture, such as the Libby Lakes. However, there are no observations, data or numerical model results to indicate this condition exists.

For those areas where ground water is either at the surface or connected hydraulically to shallow ground water flow systems (below an elevation of about 5,600 feet), drawdown due to mine dewatering would decrease the volume of water available to the surface water system, such as springs, lakes and streams. In the agencies' conceptual model, ground water and surface water are hydraulically connected below elevations of about 5,600 feet and, therefore, surface water would

be affected if ground water levels decreased due to mine dewatering (see sections 3.10.4.2.1 and 3.10.4.3.1, *Mine Area* for a discussion of potential impacts to surface water).

Drawdown – Post-mining Period

The agencies' numerical model was used to perform a transient analysis to estimate the time required for the ground water drawdown created by mine dewatering to fully recover to pre-mining levels or to steady state water levels below pre-mining water levels. Using a reasonable value for effective porosity, the results of the analysis indicated that the area would require slightly more than 20 years to recover to steady state water level conditions after the mine void was filled with water (ERO Resources Corp. 2008b). Based on an estimated inflow rate of about 450 gpm and estimated volume of the final mine void, the mine void would require about 50 years to refill. Ground water levels above the mine void are predicted to return to steady-state conditions about 70 years following mine closure and plugging of the portals. While water levels were recovering, the ground water flow direction in the region would be predominantly toward the mine void and adits and any change in base flow to streams would occur for much of this recovery period. Any change in ground water contribution to streams would decrease through the recovery period as the ground water head in the mine void increased and flow toward the mine void decreased (see *Changes in Base Flow* section below).

Mine/Adit Inflow

The agencies' numerical ground water model predicted that the total steady state inflow to the mine and adits at full build out would be about 450 gpm (for the fault scenario). The extent of the agencies' numerical model-predicted drawdown is based on inflows to the mine and adits within this range of steady state inflows. The calculated reduction in base flow to streams is also based on this range of steady state inflows. The 1992 Montanore Project Final EIS used steady state inflow of 1,200 gpm, based on estimates developed by Noranda Minerals Corp. (USDA Forest Service *et al.* 1992). MMC used a steady state inflow of 1,200 gpm in developing a project water balance (MMI 2005a, MMC 2008), but reduced steady state inflow to 800 gpm after additional analysis (Geomatrix 2007c).

Blasting during development of the adits and mine void and the presence of a mine void may result in stress redistribution that could affect local ground water flow in fractures around the mine and adits. The stress redistribution may open some fractures and close others, depending on the actual stress regime. It is unlikely this would result in a net change in the steady state inflows to the mine and adits. It is possible that changes to the fracture network resulting from the stress redistribution could affect (increase or decrease) drawdown beneath local areas and alter inflow to specific portions of the mine void and adits, but it is not possible to predict if or where this may occur.

Changes in Base Flow

The effects of ground water drawdown due to dewatering of the mine can be best expressed by estimating changes to base flow in streams. As part of the agencies' numerical model calibration process, the model results were compared to measured flows considered to be base flow in various streams that drain the area. In general, streamflow measurements were from gaging stations located on the periphery of the agencies' numerical model domain (Figure 69). Flow data from the upper reaches of the various streams are insufficient to quantify base flow at these locations. Because the model was calibrated to flow data at the periphery of the model domain and to several other direct observations, including the elevation at which streams tend to become

perennial, the model's base flow predictions at various locations along the streams are considered reasonable estimates. The model results are also based on the assumption that the predicted base flow is representative of a typical precipitation year. The agencies' numerical model predicted base flow values for the various model nodes that are comparable to the $7Q_{10}$ values calculated for several locations along various streams (see section 3.12.2, *Analysis Area and Methods*). A subsequent field review in September 2007 confirmed that base flows in the upper reaches of East Fork Rock Creek (above and just below Rock Lake) were similar to those predicted by the agencies' numerical model (see section 3.10.3.1.2, *Conceptual Model of the Mine-Area Bedrock Hydrogeology*).

Base flow for the three periods (pre-mining, mining, and post-mining) were modeled for nodes along four streams (Libby, Ramsey, and Rock creeks, and East Fork Bull River) using the agencies' numerical model (ERO Resources Corp. 2008b). Using these base flows as existing condition, the changes in flow were calculated for each model node along the streams for the mining and post-mining periods (ERO Resources Corp. 2008b). The same process was used for the cumulative analysis that included both the Rock Creek and Montanore mines (ERO Resources Corp. 2008b).

Several factors should be considered in evaluating the significance of this analysis. In many cases, the predicted changes at any given location may appear to be small compared to typical streamflows and measurement precision. For example, the model predicts changes in the upper reaches of Libby Creek of between 0.02 and 0.04 cfs for the mining period. The predicted changes in base flow at this location are about 10 percent of the model-predicted base flow. It is unlikely that such changes could be measured or detected for two reasons. First, it is difficult to measure streamflow to an accuracy greater than plus or minus 10 percent, within the range of typical flows of streams in the mine area using a streamflow meter (Wegner, pers. comm. 2007). Flow measurement error could be reduced to less than plus or minus 5 percent with the use of a flume or weir in low flow situations. Second, uncertainty in year-to-year base flow at the gaging station locations would result in a significantly higher range of values than the predicted changes. Professional judgment was used to evaluate the changes predicted by the agencies' numerical model (ERO Resources Corp. 2008b).

To estimate the duration of the predicted base flow reduction, the agencies examined the relative contribution of ground water base flow and surface water runoff to a given stream. There are very few streamflow data from the upper reaches of most streams draining the CMW. It is likely that during non-base flow periods, streamflows are probably much greater than the base flow period, but the actual flows are unknown. The agencies reviewed the hydrograph from three stream locations (Granite Creek and Flower Creek, located near Libby, Montana, and Boulder Creek, near Leonia, Idaho) where between 22 and 50 years of continuously recorded annual flow data exist. Based on these three streams, it appears that streams in the area flow at base flow for about 1 to 2 months between mid-July to early October. The stream hydrographs indicate that periods of base flow also may occur during November through March, but these base flow periods were not included in the base flow estimate of 1 to 2 months.

Libby and Ramsey Creeks

The agencies' numerical model-predicted changes in base flow in Libby and Ramsey creeks are small compared to the likely variability in determining base flow at any one location. Model-predicted changes in base flow of fractions of a cubic foot per second may occur due to mining,

but the predicted changes in base flow for the four upstream-most nodes in Libby Creek are low enough that it is unlikely changes of this magnitude would be measurable. Any reduction in base flow due to mine dewatering would persist for about 70 years after mine closure as the mine void refilled to steady-state conditions.

If total mine/adit inflow were not adequate to supply water for process purposes, MMC would likely install ground water wells for make-up water. MMC has not identified specific well locations; the most likely location would be along a major drainage, such as Libby Creek. The amount of make-up water required would depend primarily on mine inflows and precipitation at the impoundment site. MMC estimated 133 gpm would be needed on a steady-state basis if mine inflows were 800 gpm. If the numerical modeled inflows of 450 gpm were representative of actual inflows, 483 gpm of make-up water would be needed. Ground water withdrawals from Libby Creek alluvium would result in ground water level decreases near the pumping wells while the wells are in operation. Because of the relatively high hydraulic conductivity of the alluvium and the hydraulic connection with the active stream, ground water levels in the alluvium would be expected to fully recover soon after pumping ends. Potential impact on streamflow is discussed in section 3.11, *Surface Water Hydrology*.

Rock Creek

The agencies' numerical model-predicted base flow for the upper reaches of East Fork Rock Creek (above and below Rock Lake) is consistent with streamflow observed during a September 2007 site visit. In September 2007, no surface runoff or shallow ground water was contributing to the stream. All of the observed flow was from deep bedrock ground water discharge to the drainage. The flow rate out of Rock Lake was similar to the flow from East Fork Rock Creek above the lake. The agencies' numerical model predicted that changes in base flow due to mine inflow would reduce the deeper ground water contribution to East Fork Rock Creek above the lake to near zero (ERO Resources Corp. 2008b). The predicted changes would result in no flow into Rock Lake if base flow were the sole contribution of surface flow into Rock Lake, such as during late summer to early fall.

There may be some annual variability in base flow along the upper reaches of East Fork Rock Creek, but the variability is probably small compared to the predicted flow reductions (ERO Resources Corp. 2008b). About 0.75 mile below Rock Lake, East Fork Rock Creek enters a flat area with a considerable thickness of alluvium (Rock Creek Meadows). There is likely sufficient water storage in the alluvium to mask any potential reductions in base flow at this location and downstream. In other words, changes in base flow above Rock Creek Meadows predicted by the model would likely be measurable, but changes at or downstream of Rock Creek Meadows would not likely be measurable.

East Fork Bull River

The same effects predicted in the upper reaches of East Fork Rock Creek are predicted by the agencies' numerical model for the upper reaches of the East Fork Bull River drainage. The DEQ reported spring (SP-32) discharge in a drainage above St. Paul Lake near the trace of the Rock Lake fault at about 200 feet lower in elevation than the spring observed in the East Fork Rock Creek drainage (McKay, pers. comm. 2007). During normal to dry years when winters snows have completely melted, deeper ground water discharge may be the only source of water to St. Paul Lake during late summer to early fall. Spring SP-32 has not been confirmed to flow during late summer base flow period, so it is uncertain whether this spring contributes water to St. Paul

Lake during the late summer season. Because St. Paul Lake is located on a relatively permeable glacial moraine, the lake is reported to completely dry during extended periods of low or no precipitation. This indicates that either the lake drains at a faster rate than input from ground water or the lake does not receive deep ground water input during the late season.

Model-predicted reductions in base flow in the upper reaches of East Fork Bull River (above St. Paul Lake) may be a large portion of the total base flow (ERO Resources Corp. 2008b). Impacts may not be measurable when precipitation and/or remaining snow pack continue to be a source to spring and streamflow above the lake, but in drier years, impacts from mining may aggravate natural low-flow conditions. Because of the fluctuating nature of St. Paul Lake, any reduction in base flow above St. Paul Lake may not be measurable. Like Rock Creek, if the thickness of the alluvium along East Fork Bull River increased downstream of St. Paul Lake, there may be sufficient water storage in the alluvium to mask any potential reductions in base flow.

Based on the agencies' numerical model results, reduced base flow would persist during the post-mining period for a portion of the drainage until the mine void was refilled with water and the regional water table recovered. After the regional water table recovered, the agencies' numerical model predicts there would be a slight increase in ground water contribution to portions of the East Fork Bull River compared to pre-mining conditions (ERO Resources Corp. 2008b).

Base Flow Changes With 800-gpm Inflows

The previous discussion of changes in base flow is based on the agencies' numerical model, which predicted total steady state mine and adit inflows of 450 gpm. MMC estimates a steady-state inflow of 800 gpm in a revised water balance for the mine operation (Geomatrix 2008a). If the steady state inflows were 800 gpm, then the reduction in streamflow would be about two times higher than predicted by the agencies' numerical model. Using a total inflow rate of 800 gpm would not affect the changes in base flow predicted by the agencies' numerical model during the post-mining period (ERO Resources Corp. 2008b).

Summary

The agencies' numerical model predicted base flow at various locations along streams draining the mine area. The model did not consider what is possible to detect or measure. Other factors should be considered when reviewing and interpreting predicted base flow. For example, base flow at any one location along a stream may not be easily defined within the range of the model-predicted changes, but impacts from dewatering of the mine and adits may be expressed in other ways, such as changing the elevation at which streams begin to flow. Mine dewatering (and resultant ground water drawdown) may cause this elevation to move down the drainage.

Another consideration in the ability to measure or detect changes in base flow due to mine dewatering is the annual variability in precipitation. In wet years, there may be sufficient precipitation and/or remaining snowpack to mask any changes in base flow that would otherwise be observable in late summer to early fall. Also, in the middle to lower reaches of the various drainages, sufficient thicknesses of alluvium or other surficial deposits have the ability to store sufficient ground water. Ground water discharge from these deposits through the dry period would probably be sufficiently high to mask any changes in base flow resulting from mine dewatering. An example of this condition is at Rock Creek Meadows, located about 0.75 mile downstream from Rock Lake.

In contrast to the middle and lower reaches of the various streams, the upper reaches in the higher elevation portions of these drainages have either no alluvium or much thinner alluvium or other surficial deposits with limited ground water storage capacity. Late season base flow, which typically begins at elevations of 5,400 to 5,600 feet, is derived mostly from deeper ground water and may be subject to measurable changes from mine dewatering.

Another consideration in determining whether surface water would be affected by mine dewatering is to what degree the hydrogeology of the area is heterogeneous versus homogeneous. The agencies' numerical model assumed homogeneous conditions because of the lack of specific data on this issue. If the ground water flow system were controlled by structural trends, reduction in base flow may be focused in one or more of the drainages along structural trends, rather than being distributed as predicted by the model. It is not possible to predict how this condition might affect base flow with the currently available data. Ground water monitoring in piezometers drilled from within the mine adits and/or mine void would provide information on the degree of heterogeneity of the fractured bedrock system that could be used to refine model observations.

Springs and Seeps

Based on the results of the agencies' numerical model, ground water drawdown would occur around the mine as a result of dewatering of the mine void and adits. Flow from springs hydraulically connected to the deeper ground water flow path (below an elevation of about 5,600 feet (or 5,625 feet in the case of East Fork Rock Creek) would be reduced. Because springs located below an elevation of about 5,600 feet may derive their water from both shallow and deep ground water flow paths at various ratios, it is not possible to predict the amount (if any) of flow reduction. Also, there are little spring flow data for use in determining whether spring flow would be reduced by ground water production from the mine. Because data were not available, specific spring flow data were not used in the agencies' numerical model. Some springs and seeps in the mine area have been inventoried, but the inventory did not identify the specific ground water source for each spring or seep, nor did it identify critical springs in the East Fork Rock Creek and East Fork Bull River drainages.

Ground Water Quality

During the mining period, the risk posed by the underground workings of measurable changes to ground water quality would be low because ground water would be moving toward the mine void and adits and then pumped to the surface for use in the ore processing. Any water affected by the mining process, such as an increase in the concentration of nitrogen compounds due to the use of explosives or water contact with oxidizing minerals in the ore body, would be removed from the mine void, used in mill processing, and eventually stored, discharged to LAD Areas, or treated. Mine dewatering and the resulting drawdown of bedrock ground water could result in subtle changes in water quality of various water bodies, such as Rock Lake, and unidentified springs and seeps. Assuming these water bodies receive water from both shallow and deep ground water sources, reducing the source of deeper ground water could reduce the introduction of certain minerals considered to be necessary for potential populations of organisms (Gurrieri 2001, 2004). If this water quality change occurred, it may be difficult to detect or measure.

During the post-mining period after the mine void filled and the surrounding area resaturated (an estimated 70 years), the agencies' numerical model predicts that ground water in the mine void has the potential to flow toward the East Fork Bull River drainage. The predicted concentrations of metals in the mine void ground water would be relatively low. If ground water flowed from the

filled mine void to the East Fork Bull River, attenuation and dilution of the dissolved metals as the ground water moved about 3,000 feet vertically through fractures would likely reduce concentrations. The actual flow path may be longer than 3,000 feet. The fate and transport of dissolved metals within the flooded mine void cannot be predicted without significant uncertainty, particularly considering the relatively low surface water quality standards. MMC intends to construct a three dimensional ground water model during the mine development period when additional hydraulic data would be collected. A calibrated model could be used to evaluate the potential for the migration of dissolved metals from the mine void to surface water drainages such as the East Fork Bull River. If modeling were to indicate potential exceedances of surface water standards in nearby streams, various mitigation measures would have to be adopted prior to active mining. The agencies' numerical model indicates that during the post-mining period, there would be the potential for ground water to flow toward the mine void from the East Fork Rock Creek drainage (including Rock Lake). If this occurred, there may be subtle changes in the water quality of Rock Lake, as described in the previous paragraph.

3.10.4.2.2 Tailings Impoundment

Ground Water Levels and Flow

The Little Cherry Creek Tailings Impoundment is designed with an underdrain system to collect seepage from the tailings and divert intercepted water to a Seepage Collection Pond downgradient of the impoundment. After being discharged into the impoundment, the tailings would consolidate, and water would pool in a reclaim water pond within the tailings impoundment. Water from the reclaim water pond would be pumped back to the mill, but some would percolate downward and be captured by the underdrain system. Some of the percolating water would seep into the underlying fractured bedrock aquifer. Geotechnical investigations near the Seepage Collection Pond indicate that the fractured bedrock is at the surface in the Little Cherry Creek channel beneath the proposed Seepage Collection Dam and farther downstream (Morrison-Knudsen 1990). The Seepage Collection Pond may intercept some of the tailings seepage in the fractured bedrock aquifer. Because bedrock crops out downstream of the proposed dam location, tailings seepage in the fractured bedrock aquifer not intercepted by the Seepage Collection Pond or extracted by a pumpback well system would likely flow into the former Little Cherry Creek channel (USDA Forest Service 2008a). Some of the seepage may flow to Libby Creek via a buried channel beneath the impoundment site. Klohn Crippen (2005) estimated 80 percent of the existing ground water flows toward Little Cherry Creek and 20 percent flows toward Libby Creek via the buried channel. Any tailings seepage is likely to follow existing ground water flow paths if not intercepted.

Tailings seepage not collected by the underdrain is expected to flow to ground water at a rate of about 25 gpm and, after the impoundment is reclaimed, slowly decrease to 5 gpm (Klohn Crippen 2005). The operational seepage estimate was verified by the lead agencies in their independent analysis (USDA Forest Service 2008a). The estimated ground water flux (volume per unit time) beneath the impoundment was estimated to be about 35 gpm (Geomatrix 2007a) using a DEQ standard mixing zone thickness of 15 feet (ARM 17.30.517) and a hydraulic conductivity for the impoundment area of 0.4 ft/day. A conductivity value of 0.4 ft/day is higher than the mean values reported by Klohn Crippen (2005) to estimate tailings seepage for glacial till beneath the Little Cherry Creek Impoundment Site (0.1 ft/day) and for fractured bedrock (0.3 ft/day). The saturated zone beneath the impoundment would be able to accommodate the addition of about 25 gpm from seepage and would respond with a rising water table (slightly increasing the hydraulic gradient) to convey the additional water from beneath the impoundment. Little Cherry Creek appears to be a

gaining stream downgradient of the proposed impoundment based on limited flow measurements and the occurrence of numerous springs.

Springs and Seeps

Numerous springs and seeps were identified in the Little Cherry Creek drainage (Figure 72) (Geomatrix 2006c). Springs SP-15, 23, and 24 would be covered during initial impoundment construction, and a fourth spring (SP-10) would be covered by the Seepage Collection Pond. Seeps in Little Cherry Creek also would be covered during initial impoundment construction. The pumpback well system needed to extract seepage not collected by the underdrain system would likely lower ground water levels and reduce ground water discharge to springs, seeps, and wetlands downgradient the impoundment.

Ground Water Quality

The existing ground water quality would be altered because tailings seepage water quality would have higher concentrations of nutrients, some metals, and total dissolved solids than existing water quality. The agencies completed mass balance calculations (Appendix G) of expected seepage rates and water quality from the tailings impoundment for the construction, mining, and post-mining periods. The uncertainties associated with the mass balance calculations are discussed in section 3.11.2.3, *Impact Analysis* in section 3.11, *Surface Water Hydrology*. Using the DEQ's approach for determining a standard mixing zone (ARM 17.30.517), MMC calculated a ground water flux of 10 gpm. An additional 25 gpm was added to the calculated flux to account for flow in the buried alluvial channel (Geomatrix 2007b). The hydrologic and geologic conditions of the Little Cherry Creek Tailings Impoundment Site are complex. As noted by Morrison-Knudsen Engineers, Inc. (1990), "Complete definition of the hydrogeologic system at the [Little Cherry Creek Tailings Impoundment] site probably would not be possible. Costs associated with substantial definition of the hydrogeologic system would be prohibitive because of the size of the system and its complexity." The agencies used a ground water flux of 35 gpm in the agencies' mass balance calculations as a reasonable estimate of flux beneath the impoundment site. Results of the mass balance analysis are provided in Table 82.

The predicted elevated manganese concentrations would occur in ground water beneath and downgradient of the tailings impoundment. During the MPDES permitting process, the DEQ would determine if a mixing zone beneath and downgradient of the tailings impoundment would be allowed and, if so, would determine the mixing zone's size, configuration, and location. MMC requested a source-specific mixing zone for the tailings impoundment. The DEQ would determine if a source-specific mixing zone should be granted in accordance with ARM 17.30.518. If DEQ granted a mixing zone, water quality changes may occur and certain water quality standards may be exceeded within the mixing zone. The DEQ also would determine where compliance with applicable standards would be measured.

MMC has committed to implementing seepage control measures, such as pumpback wells, if required to comply with applicable standards. Seepage collection wells could be installed along the downstream toe of the tailings dam. Given the heterogeneity of the foundation soils, additional wells could be required to ensure that all of the flow paths were intercepted. The wells may require active pumping, depending on the artesian pressures within the wells (Klohn Crippen 2005).

Table 82. Predicted Concentrations in Ground Water beneath the Tailings Impoundment.

Parameter	Alternatives 2 and 4	Alternative 3	Ground Water Standard or BHES Order Limit
During Construction			
Total dissolved solids	123	123	200
Nitrate	3.9	<3.5	10
Antimony	<0.004	<0.004	0.006
Cadmium	<0.001	<0.001	0.005
Copper	<0.02	<0.02	0.1
Iron	<0.05	<0.05	0.2
Lead	<0.01	<0.01	0.015
Manganese	**<0.15**	**<0.13**	0.05
Silver	<0.002	<0.002	0.1
Zinc	<0.02	<0.02	0.1
During Mining			
Total dissolved solids	141	139	200
Nitrate	6.8	<6.1	10
Antimony	<0.006	<0.005	0.006
Cadmium	<0.001	<0.001	0.005
Copper	<0.02	<0.02	0.1
Iron	<0.05	<0.05	0.2
Lead	<0.01	<0.01	0.015
Manganese	**<0.24**	**<0.22**	0.05
Silver	<0.002	<0.002	0.1
Zinc	<0.02	<0.02	0.1
During Post-Mining			
Total dissolved solids	112	113	200
Nitrate	2.1	<1.8	10
Antimony	<0.004	<0.004	0.006
Cadmium	<0.001	<0.005	0.005
Copper	<0.01	<0.01	0.1
Iron	<0.05	<0.05	0.2
Lead	<0.01	<0.01	0.015
Manganese	**<0.09**	**<0.08**	0.05
Silver	<0.001	<0.001	0.1
Zinc	<0.02	<0.02	0.1

All concentrations are in mg/L.
Predicted exceedances of BHES Order limits or ground water standards are shown in **bold**.

Seepage from the tailings impoundment reaching ground water is estimated to decrease from 25 gpm to 17 gpm 10 years after closure, stabilizing at 5 gpm over the long term (Klohn Crippen 2005). Water quality beneath the impoundment would improve slowly over time as seepage decreased and infiltrated precipitation mixed with water retained in the impoundment. MMC would maintain and operate necessary seepage collection facilities until water quality standards

and MPDES permit limits were met, without treatment, in all receiving waters. MMC also would continue water monitoring as long as the MPDES permit is in effect. As long as post-closure water treatment is required, the agencies would require a bond for the operation and maintenance of the water treatment plant. The level of human activity associated with facility operation, maintenance and monitoring is unknown, but has the potential of being a daily requirement and year-round in duration. The length of time these closure activities would occur is not known, but may be decades or more.

3.10.4.2.3 LAD Areas

Ground Water Levels and Flow

MMC proposes to apply up to 558 gpm of water to the LAD Areas during the mining period (Geomatrix 2007a). There are several considerations for disposal of water on the LAD Areas to avoid runoff from the LAD Areas and minimize the risk of developing springs and seeps downgradient of the LAD Areas. The two basic issues are:

- The maximum application rate that would not result in runoff from the site given site characteristics
- The maximum application rate that could be conveyed away from the LAD Areas by the existing ground water system

The EPA (2006b) and Corps (1982b) published guidelines for the design and operation of LAD Areas that address the first issue. The guidelines provide recommended design percolation rates that consider long-term issues such as wetting and drying cycles, clogging of the soil, etc. Using the guidelines, the maximum application rate that would not result in surface runoff for the LAD Areas is 344 gpm (see section 3.12.2.3, *Impact Analysis* for further discussion).

The existing ground water flux beneath the LAD Areas was estimated to determine the capacity of the underlying shallow aquifer to receive and transport additional water. The agencies initially calculated a ground water flux of 141 gpm, based on the following assumptions:

- Maximum saturated thickness of 56 feet (as reported in well logs), which is greater than the 15 feet using the dispersion assumptions in ARM 17.30.517 for standard mixing zones, but represents actual conditions to the maximum drilled depth
- Mixing zone width beneath the LAD Areas of 6,860 feet, which is increased to 8,060 feet using the dispersion assumptions in ARM 17.30.517 for standard mixing zones, where the mixing zone width is equal to the width plus the distance determined by the tangent of 5 degrees times the length of the LAD Area on both sides
- Existing hydraulic gradient of 0.06 (Geomatrix 2007a)
- A hydraulic conductivity value of 1 ft/day reported by Geomatrix (2007a)

The calculated ground water flux using the reported hydraulic conductivity value requires an unrealistic net infiltration of precipitation rate of about 52 percent of annual precipitation to maintain the ground water flux of 141 gpm through the defined cross sectional area. It is likely that the average hydraulic conductivity value used in the calculation is too high and does not reflect site conditions. The ground water flow direction is generally perpendicular to surface topography contours or downslope and, therefore, ground water recharge is local and discharge is

to the adjacent streams. A small fraction of the total net infiltration may travel along deeper flow paths in the fractured bedrock.

The hydraulic conductivity of 1 ft/day is the only value in the flux calculation that was not directly measured, but rather was selected by MMC (2005) as being more representative of the LAD hydraulic conductivity than the value derived from pit tests. The agencies reduced the hydraulic conductivity value slightly to achieve a ground water flux that is consistent with a reasonable net infiltration rate. The agencies considered 10 percent to be a reasonable net infiltration value to use in the flux calculation for three reasons. In the tailings impoundment design report, Klohn Crippen (2005a) indicated "ground water recharge from infiltration [at the Little Cherry Creek Impoundment Site] was estimated to be 10 percent of yearly precipitation. Infiltration rates could be as low as 5 percent and are not expected to be greater than 12 percent. The relatively low precipitation and forest cover suggest that 10 percent should be the maximum infiltration." MMC also used a 10 percent infiltration rate in the SEEP/W analysis (Klohn Crippen 2005a) to model seepage from the Little Cherry Creek Tailings Impoundment; the agencies' used the same rate in their independent SEEP/W analysis (USDA Forest Service 2008a). The LAD Areas are 2 miles south of the Little Cherry Creek Tailings Impoundment and have similar geology. A 10 percent infiltration rate in areas of less than 30 percent slope also was used in the agencies' numerical ground water model (ERO Resources Corp. 2008b).

An infiltration rate of 10 percent would support a ground water flux of 31 gpm for the LAD Areas. This is similar in magnitude to what was calculated by MMC for the ground water flux through a similar cross sectional area beneath the Little Cherry Creek Tailings Impoundment (35 gpm). Using a ground water flux of 31 gpm (rather than 141 gpm) requires the hydraulic conductivity to be lower (0.22 ft/day) because the other variables in the equation are fixed (gradient and cross sectional area). A conductivity value of 0.22 ft/day is slightly higher than the mean value for glacial till beneath the Little Cherry Creek Impoundment Site (0.1 ft/day) reported by Klohn Crippen (2005).

The agencies calculated the maximum amount of water that could be conveyed away from the site using a hydraulic conductivity value of 0.22 ft/day, and assuming the water table could rise to within about 10 feet of the surface beneath the LAD Areas. The agencies assumed the water table should remain 10 feet below ground surface beneath the LAD Areas so there would be sufficient unsaturated zone to receive the percolating applied water. Because the cross-sectional area and aquifer characteristics would not change during LAD, the hydraulic gradient would steepen to allow more water to move away (downgradient) from the LAD Areas. The increased gradient is estimated to be 0.122. The calculated gradient value of 0.122 is assumed to be the maximum possible gradient with a depth to ground water of 10 feet beneath the LAD Areas. The agencies estimate the ground water flux (preexisting ground water flux plus infiltrated application water) is about 63 gpm, or about 32 gpm of LAD applied water (the difference between maximum possible flux (63 gpm) and the pre-application ground water flux (31 gpm)). Factoring in precipitation and evapotranspiration, the total maximum application rate to the LAD Areas would be about 130 gpm for a LAD Area of 200 acres (Appendix G).

The estimated application rate of 130 gpm that could be conveyed from the LAD Areas is more restrictive than 344 gpm, a rate the agencies calculated using the EPA and USACE guidelines to avoid runoff (EPA 2006b; Corps 1982b). To reduce the likelihood that springs and seeps would develop downgradient of the LAD Areas or that the water table would come to the surface in the LAD Areas, the agencies estimate the maximum application rate would be 130 gpm (for the 200

acres proposed by MMC for land application at LAD Areas 1 and 2). MMC's proposed application rate of 558 gpm would likely result in surface water runoff and increased spring and seep flow on the downhill flanks of the LAD Areas.

The agencies estimated a ground water velocity and travel time between the LAD Areas and the nearest surface water body to aid in planning downgradient ground water monitoring. Using a range of effective porosity values of 1 to 10 percent, ground velocity is calculated to range from about 100 feet per year to 1,000 feet per year. Assuming the nearest stream is about 800 feet downhill from the LAD Areas, the ground water travel time is estimated to be between less than 1 year and 8 years. This calculation does not consider the existence of preferential flow paths that would allow for higher ground water velocities, and a possible shorter travel time.

MMC proposed an alternate set of values for hydraulic conductivity (0.3 ft/day) and cross-sectional width (15,000 feet) in calculating the maximum application rate (Geomatrix 2008b). Because of the limited subsurface data available for the LAD Areas, it is not possible to refine the estimated application rate beyond what is presented in this EIS. Therefore, the analysis presented in this EIS uses more conservative assumptions versus what was suggested by MMC. The maximum application rate would depend on the site conditions, and would have to be determined on a performance basis by monitoring both water quality and quantity changes to the existing ground water system. It is possible that monitoring would determine that the maximum application rate would be higher or lower than estimated by this analysis. The LAD application rates would be selected to ensure that ground water did not discharge to the surface as springs between the LAD Areas and downgradient streams.

Springs and Seeps

The discharge rate of the existing spring (SP-21) between the two LAD Areas (Figure 72) may increase as a result of land application of excess water. Assuming the LAD Areas are operated at the maximum application rate of 130 gpm and the evaporation and precipitation rates assumed in the calculation are representative of site conditions, there should be no increase in the number of springs and/or seeps downgradient of the LAD Areas. Springs or seeps could develop because of unidentified geologic heterogeneities that would result in preferential flow paths to the surface. An increase in the overall water table elevation beneath the LAD Areas as a result of applying a maximum of 130 gpm, based on the assumptions described previously, would have no adverse impacts, with the exception of possible preferential flow paths that could result in increased spring activity.

Ground Water Quality

Percolation from the LAD Areas would enter the ground water system and would discharge at nearby springs and/or eventually to adjacent streams as diffuse flow. The existing ground water quality beneath the LAD Areas would be altered because discharged wastewater percolating into ground water beneath the LAD Areas would have higher concentrations of nitrate, several metals, and total dissolved solids than the existing water quality (Appendix G). Results of the mass balance are provided in Table 83.

Table 83. Predicted Concentrations in Ground Water beneath the LAD Areas.

Parameter	Alternative 2	Alternatives 3 and 4	Ground Water Standard or BHES Order Limit
During Construction			
Total dissolved solids	**376**	**384**	200
Nitrate	**<26.03**	<2.88	10
Antimony	<0.005	<0.005	0.006
Cadmium	<0.0004	<0.0004	0.005
Copper	<0.002	<0.002	0.1
Iron	<0.08	<0.08	0.2
Lead	<0.002	<0.002	0.015
Manganese	<0.04	<0.04	0.05
Silver	<0.001	<0.001	0.1
Zinc	<0.07	<0.07	0.1
During Mining			
Total dissolved solids	**346**	**353**	200
Nitrate	**<17.32**	<2.06	10
Antimony	**<0.009**	**<0.009**	0.006
Cadmium	<0.0003	<0.0003	0.005
Copper	<0.007	<0.007	0.1
Iron	<0.06	<0.06	0.2
Lead	<0.001	<0.001	0.015
Manganese	**<0.08**	**<0.08**	0.05
Silver	<0.002	<0.002	0.1
Zinc	<0.04	<0.04	0.1
During Post-Mining			
Total dissolved solids	**455**	**531**	200
Nitrate	**<16.85**	<2.20	10
Antimony	**<0.011**	**<0.013**	0.006
Cadmium	<0.0021	<0.0025	0.005
Copper	<0.008	<0.009	0.1
Iron	<0.07	<0.07	0.2
Lead	<0.003	<0.003	0.015
Manganese	**<1.02**	**<1.22**	0.05
Silver	<0.004	<0.005	0.1
Zinc	<0.05	<0.05	0.1

All concentrations are mg/L.
Predicted exceedances of BHES Order limits or ground water standards without additional treatment beyond land application in Alternative 2, or beyond nitrate pretreatment and land application in Alternatives 3 and 4 are shown in **bold**.

Concentrations of total dissolved solids, antimony, and manganese in all alternatives, nitrate in Alternative 2, and zinc in Alternatives 3 and 4 are predicted to exceed ground water standards or BHES Order nondegradation limits in one or more phases of mining. The predicted elevated

concentrations would occur in ground water beneath and downgradient of the LAD Areas. During the MPDES permitting process, the DEQ would determine if a mixing zone beneath and downgradient of the LAD Areas would be allowed and, if so, would determine the mixing zone's size, configuration, and location. MMC requested a source-specific mixing zone for the LAD Areas. The DEQ would determine if a source-specific mixing zone should be granted in accordance with ARM 17.30.518. If DEQ granted a mixing zone, water quality changes may occur and certain water quality standards may be exceeded within the mixing zone. The DEQ also would determine where compliance with applicable standards would be measured.

Ground water beneath the LAD Areas would have higher concentrations of total dissolved solids, nutrients, and metals as long as the seepage collection facilities at the tailings impoundment operates and tailings water is discharged at the LAD Areas. Concentrations shown in Table 83 for the post-mining period are those predicted to occur immediately after the mill ceased production. As infiltrated precipitation mixed with water retained by the tailings, the quality of collected tailings seepage would improve, and the concentrations beneath the LAD Areas would be less than those shown in Table 83. The length of time tailings water may be discharged at the LAD Areas is not known, but may be decades or more.

3.10.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

3.10.4.3.1 Mine Area

Ground Water Levels and Flow

Alternative 3 would have the similar effects and uncertainties on ground water levels overlying the ore body and base flow in Rock Creek and East Fork Bull River as Alternative 2. If hydrologic modeling during initial mine operations (by Year 5 of operations) determined that one ore more bulkheads would be necessary to minimize changes in East Fork Rock Creek and East Fork Bull River streamflows, MMC would submit a plan for bulkheads to the agencies for approval. One or more bulkheads would be maintained underground, if necessary, after the plan's approval. The introduction of a 330-foot (100-meter) thick bulkhead in the agencies' numerical model reduced the post-mining ground water contribution from the mine void to the East Fork Bull River by 50 percent, compared to Alternative 2. The addition of the bulkhead would increase flow slightly to the Rock Creek drainage from the mine void, rather than reducing flow to that drainage without a bulkhead. The agencies' model predicted a bulkhead would increase post-mining ground water pressure in the upper end of the mine void near Rock Lake and would cause ground water to flow toward East Fork Rock Creek, rather than away from it. Ground water pressure in the lower portion of the mine void (below the bulkhead) would be lower than without the bulkhead, reducing ground water flow toward the East Fork Bull River.

In Alternative 3, two adits in addition to the Libby Adit would be in the Libby Creek drainage near the existing Libby Adit. The Ramsey Adits would not be constructed. Changes in base flow in Ramsey Creek would be nearly zero and not measurable in Alternative 3. Three adits in the Libby Creek drainage may reduce base flow in Libby Creek more than predicted for Alternative 2, but the changes would be relatively small, and would depend on the additive effect of two additional adits adjacent to the Libby Adit. The ground water drawdown resulting from inflow to each of the three adits would overlap. The total water production of three adjacent adits would be much less than three adits located beneath different drainages.

Springs and Seeps and Ground Water Quality

Changes in spring and seeps, and ground water quality in the mine area in Alternative 3 would be the same as Alternative 2. Alternative 3 would require implementation of Ground Water Dependent Ecosystem Inventory and Monitoring (Appendix C), focusing on areas below an elevation of about 5,600 feet. Such monitoring would assist in inventorying springs and seeps in the mine area, and in evaluating mine-related changes to springs and seeps.

3.10.4.3.2 Tailings Impoundment

Ground Water Levels and Flow

The Poorman Tailings Impoundment location proposed in Alternative 3 would be located between the Poorman Creek and Little Cherry Creek drainages. The available hydrogeologic data from this proposed impoundment location indicate that the Poorman site is similar to the Little Cherry Creek site with the exception of having generally higher hydraulic conductivity than the Little Cherry Creek site. The effects of Alternative 3 would be similar to Alternative 2 (see section 3.10.4.2.2, *Tailings Impoundment*), with the following differences:

- Based on available data, there does not appear to be a buried channel on the Poorman site, compared to the Little Cherry Creek site, which eliminates the concern of having a high hydraulic conductivity conduit beneath an impoundment that could become a preferential flow path for seepage from the impoundment.
- The impoundment would not be located directly in the Poorman Creek drainage, but north of the drainage. Consequently, the predominant ground water flow direction from beneath the impoundment is to the east toward Libby Creek, rather than toward the much smaller Poorman Creek.
- Any tailings seepage that reached ground water would be more difficult to control than at the Little Cherry Creek site.

In Alternative 3, the agencies identified a possible location for alluvial ground water wells to supply make-up water to the mine, should mine inflow be inadequate for process purposes. To provide any necessary make-up water requirements, a water supply well field located north of the Seepage Collection Pond would draw from Libby Creek alluvial ground water (Figure 26). The proposed well field location has surficial alluvial and glacial deposits up to 200 feet thick and adequate flow in adjacent Libby Creek. Because the tailings would be deposited at a higher density in Alternative 3, less water would be stored initially in the impoundment and more water would be available for mill use. As in Alternative 2, the amount of make-up water required would depend primarily on mine inflows and precipitation at the impoundment site. No make-up would be needed if mine inflows were 800 gpm, and about 150 gpm would be needed if mine inflows were 450 gpm. Ground water levels downgradient of the pumping wells would decrease while the wells were pumped. Appropriately designed, located, and operated make-up wells providing up to 150 gpm would not substantially reduce upgradient alluvial ground water levels.

Springs and Seeps

Five springs were identified in the Poorman Tailings Impoundment Site (Figure 72). Springs SP-26, SP-28, SP-29, and SP-30 would be covered by the impoundment; SP-27 would not be affected. As in Alternative 2, it is possible that the increase in hydraulic head over the springs by placement of saturated tailings would prevent future flow from the springs. Alternately, the springs could discharge to the underdrain system beneath the impoundment and become part of

the seepage collection system. No springs were identified below the Poorman Tailings Impoundment Main Dam and a pumpback well system would not affect any spring flow.

Ground Water Quality

The effect of tailings seepage on existing ground water quality beneath the impoundment is provided in Table 82. Ground water flow beneath the Poorman Impoundment Site is estimated to be slightly higher than at the Little Cherry Creek site. Based on the mass balance calculations, the predicted manganese concentration in ground water would be greater than the BHES Order nondegradation limit of 0.05 mg/L in all three periods. The process of any approval by the DEQ of any mixing zone and compliance with applicable standards in Alternative 3 would be the same as Alternative 2.

Post-operations water quality would be similar to Alternative 2. MMC would maintain and operate necessary seepage collection facilities until water quality standards and MPDES permit limits were met, without treatment, in all receiving waters. The length of time these closure activities would occur is not known, but may be decades or more.

3.10.4.3.3 LAD Areas

Ground Water Levels and Flow

The environmental consequences described for Alternative 2 (section 3.10.4.2.3, *LAD Areas*) would apply to Alternative 3 with the following exception. In Alternative 3, the location and configuration of the LAD Areas are slightly changed, increasing the area from 200 acres to 307 acres. Because of the proposed changes to the total LAD Area, the calculated ground water flux and calculated maximum application rate would be higher. The calculated preapplication ground water flux for Alternative 3 is about 46 gpm and the calculated maximum application rate would be about 198 gpm.

Springs and Seeps

The effects of Alternative 3 on springs and seeps in the LAD Areas would be the same as Alternative 2 (section 3.10.4.2.3, *LAD Areas*).

Ground Water Quality

Ground water quality at the LAD Areas would be similar to Alternative 2 (section 3.10.4.2.3, *LAD Areas*). Treatment of wastewater for nitrates prior to LAD may be required in Alternatives 3 and 4. Such treatment also may reduce the concentrations of total dissolved solids and metals in discharged wastewater. Results of the mass balance analysis are provided in Table 83.

BHES Order nondegradation limits for total dissolved solids and manganese are predicted to be exceeded in ground water without treatment prior to application (the manganese exceedance is in part due to the ambient ground water concentration exceeding the BHES Order nondegradation limit). If excess mine/adit water discharged at the LAD Areas would result in exceedances of applicable ground water standards beyond the boundaries of the mixing zone, MMC has committed to treating the water at the Libby Adit treatment facility and, if needed, an additional water treatment facility. The process of any approval by the DEQ of any mixing zone and compliance with applicable standards in Alternative 3 would be the same as Alternative 2.

Ground water beneath the LAD Areas would have higher concentrations of total dissolved solids, nutrients, and metals as long as the seepage collection facilities at the tailings impoundment operates and tailings water is discharged at the LAD Areas. The length of time these closure activities would occur is not known, but may be decades or more.

An identified spring between the two LAD Areas (SP-21, see Figure 72) would be part of the hydrology monitoring plan (Appendix C). Inclusion of this spring in the monitoring plan would better detect potential changes in water quality beneath LAD Area 1.

3.10.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

3.10.4.4.1 Mine Area

Alternative 4 would have the same effects and uncertainties on ground water levels and springs and seeps overlying the ore body and base flow in Rock Creek and East Fork Bull River as Alternative 3 (section 3.10.4.3.1, *Mine Area*). The effects of the Libby Adits would be the same as Alternative 3. The effect of make-up wells on ground water levels in Alternative 4 would be the same as Alternative 2 (section 3.10.4.2.2, *Tailings Impoundment*). The agencies identified a well field location between Libby Creek and the Little Cherry Creek Impoundment.

3.10.4.4.2 Tailings Impoundment

Changes in ground water flow and quality, as well as in springs and seeps in the Little Cherry Creek Tailings Impoundment Site in Alternative 4 during and after operations, would be the same as Alternative 2. Ground water monitoring would be different from Alternative 2 (Appendix C), and would better detect changes in springs and seeps. The process of approval by the DEQ of any mixing zone in Alternative 4 also would be the same as Alternative 2 (section 3.10.4.2.2, *Tailings Impoundment*).

The amount of seepage collected by the seepage collection facilities may be increased by locating the Seepage Collection Pond with respect to the local geologic conditions. Geotechnical investigations at the Little Cherry Creek Impoundment Site were conducted on behalf of Noranda between 1988 and 1990. Noranda reported that bedrock is exposed in the Little Cherry Creek channel and bedrock extended about 800 feet downstream of the proposed Seepage Collection Dam (Morrison-Knudsen Engineers, Inc. 1990). Ground water modeling conducted by MMC (Klohn Crippen 2005) and independently verified by the agencies (USDA Forest Service 2008a) assumed that the fractured bedrock strata in the Little Cherry Creek drainage is the primary aquifer for ground water flow at the site. The modeling indicated that any tailings seepage not intercepted by the seepage collection and pumpback well systems would likely discharge to the Little Cherry Creek watershed through the fractured bedrock aquifer (USDA Forest Service 2008a). If not intercepted, some of the seepage may flow to Libby Creek via a buried channel beneath the impoundment site. Klohn Crippen (2005) estimated 80 percent of the existing ground water flows toward Little Cherry Creek and 20 percent flows toward Libby Creek via the buried channel. Any tailings seepage is likely to follow existing ground water flow paths. Consequently, siting the Seepage Collection Dam at or below the location where bedrock outcrops in the Little Cherry Creek drainage would increase the likelihood that the seepage would be collected by the dam. In Alternative 4, MMC would conduct additional geotechnical work near the Seepage Collection Dam during final design and site the dam lower in the drainage if technically feasible.

3.10.4.4.3 LAD Areas

Changes in ground water flow and quality during and after operations, as well as in springs and seeps in the LAD Areas, in Alternative 4 would be the same as Alternative 3 (section 3.10.4.3.3, *LAD Areas*. The process of approval by the DEQ of any mixing zone in Alternative 4 also would be the same as Alternative 2 (section 3.10.4.2.2, *Tailings Impoundment*).

3.10.4.4.4 Ground Water Monitoring

A GDE inventory of an area overlying the mine area and subsequent monitoring of GDEs (Appendix C) would be completed in Alternative 4, as described in Alternative 3. A spring between the two LAD Areas (SP-21 see Figure 72) would be part of the hydrology monitoring plan (Appendix C). In addition, flow from springs SP-02, SP-10, S-12, SP-14, SP-15, and SP-29 in the Little Cherry Creek Impoundment Site (Figure 41) would be measured twice in Alternative 4, once in early June when the area was initially accessible, and once between mid-August and mid-September 1 year before construction began. (Springs SP-02 and SP-15 would not be monitored if they were covered by impoundment facilities.) Samples from these springs would be collected 1 year before construction began and analyzed for total dissolved solids, nitrate + nitrite, sulfate, antimony, and manganese. Sampling would be repeated every 2 years until tailings disposal ceased. At each spring, a vegetation survey would be completed 1 year before construction began; the survey and establishment of "trigger plants" would be the same as Alternative 3 (Appendix C). Such monitoring would assist in inventorying springs and seeps in the tailings impoundment area, and in evaluating mine-related changes to springs and seeps.

3.10.4.5 Cumulative Effects

3.10.4.5.1 Past and Current Actions

The Heidelberg Adit is a horizontal tunnel that was constructed in the 1920s. The adit extends about 790 feet into a cliff face located along East Fork Rock Creek about 850 vertical feet below Rock Lake. Ground water flow from the adit is reported to range from 45 to 135 gpm (Gurrieri 2001). In September 2007, flow from the adit was estimated to be 50 gpm and because of dry conditions at the time of the site visit, this flow is considered to be base flow from bedrock. Because flow data were apparently not collected prior to construction of this adit, it is not known if the adit outflow affected base flow in nearby East Fork Rock Creek.

The Libby Adit was constructed between 1990 and 1991 by Noranda and is about 14,000 feet long. Ground water inflow to the adit increased as the adit was driven, peaking at 239 gpm. The steady state flow from the adit was 150 gpm. Surface flow monitoring was insufficient to identify possible reductions in base flow in Libby Creek. It is not known whether changes in base flow, if they occurred, would have been measurable. There were no ground water piezometers at the time the adit was constructed to identify changes in ground water levels near the adit.

3.10.4.5.2 Rock Creek Project

The agencies' numerical ground water model was used to assess the cumulative effects of the Montanore and Rock Creek mines. The approximate footprint of the Rock Creek Mine was used in the existing agencies' numerical Montanore model. Using the same conceptual model as used in the agencies' Montanore numerical model, simultaneous operation of the two mines was modeled to determine the steady-state drawdown in the region and the resulting reduction in ground water contribution to surface water.

The agencies' numerical model predicts that the combined drawdown from the Rock Creek and Montanore mines would merge in the area between the two mines (Figure 74). The agencies' numerical model indicates that only the westernmost portion of the Montanore drawdown cone and the easternmost portion of the Rock Creek drawdown cone would be affected by dewatering at the other mine. The model predicts that there would be more drawdown in the area between the two mines, in response to dewatering activities at both mines, as opposed to drawdown created by a single mine. During the post-mining period, the steady state recovered drawdown cones of the two mines are predicted to merge in the area between the two mines (Figure 75).

Other than ground water drawdown, potential impacts to ground water would be expressed by changes to ground water flow to streams, and springs. Because there is no comprehensive inventory of springs in the area, only ground water contribution to major streams was considered as a measure of the potential impact to ground water. The cumulative analysis predicts the base flow in East Fork Rock Creek and East Fork Bull River would decrease as a result of drawdown from the two mines (ERO Resources Corp. 2008b). No additional impacts would occur in Libby Creek or Ramsey Creek from the Rock Creek Mine. Although the model was calibrated to base flow data, the significance of this analysis is not the absolute values of flow reported for the various drainages, but rather the predicted changes in each drainage relative to the modeled base flow.

The agencies' numerical model predicted mining period changes to base flow in the upper reaches of each drainage of Rock Creek and East Fork Bull River that are relatively large compared to calculated pre-mining base flow (ERO Resources Corp. 2008b). This indicates that the base flow in the upper reaches of each stream could be reduced in the first mile below St. Paul Lake and Rock Lake. The agencies' numerical model indicates that portions of East Fork Rock Creek south of the proposed Rock Creek Mine would experience additional reduction to base flow (ERO Resources Corp. 2008b). The agencies' numerical model also predicts reductions in base flow during the post-mining period, but they are relatively small compared to the predicted base flow and may not be measurable.

3.10.4.5.3 Other Reasonably Foreseeable Actions

No other reasonably foreseeable actions would have cumulative effects on ground water flow or quality.

3.10.4.6 Regulatory/Forest Plan Consistency

All mine and transmission line alternatives would be in compliance with the Montana Water Quality Act because construction, operation, and closure of the mine and transmission line under all alternatives would be in compliance with all applicable water quality standards and permit requirements.

3.10.4.7 Irreversible and Irretrievable Commitments

A certain percentage of the total precipitation that falls in the Cabinet Mountains flows from the mountains as surface and ground water. The total yield varies from year-to-year as a function of the total precipitation and varying amounts of evapotranspiration. During the mining period, a certain amount of water would be consumptively used by the project, reducing the total yield of the region by that amount. Relative to the total yield, the consumptively used volume is expected to be small. The reduction in yield would be an irretrievable commitment of resources.

After the mine void filled, the total water yield of the region would return to pre-mining conditions, but because of the large mine void, the distribution of water produced along the headwaters of the four major streams that drain the area may be changed permanently. The large mine void with an infinitely high hydraulic conductivity would permanently change the ground water flow paths. The post-mining analysis indicates that changes in ground water contributions to streams are expected to be relatively small compared to the total flow and the changes would probably not be measurable. If the ground water flow system were controlled by structural trends, reduction in base flow may be focused in one or more of the drainages along structural trends. Any change in base flow would be an irreversible commitment of resources.

Because of the permanent change in ground water flow paths, there may be slight changes in the relative contribution of deeper and shallow ground water to surface water bodies such as Rock Lake. The resulting water quality changes would be small and may not be measurable. These changes would be an irreversible commitment of resources.

Springs would be irreversibly covered by the tailings impoundment in all action alternatives.

3.10.4.8 Short-term Uses and Long-term Productivity

As described above, there would be a short-term reduction in available water from this portion of the Cabinet Mountains equal to the consumptive use of the mine. Given the overall flow rate of streams from this area, the total short-term change would be small. There would be no long-term reduction in water availability of this area, but the distribution among the four major drainages may be slightly altered.

3.10.4.9 Unavoidable Adverse Environmental Effects

The consumptive use of ground water by the project would unavoidably reduce the total water yield from this portion of the Cabinet Mountains. The anticipated consumptive use is expected to be small relative to the total water yield of this area. Water yield would remain reduced until the project no longer consumptively uses water, and then slowly return to the pre-mining yield as the mine void filled, which would require about 50 years. An additional estimated 20 years would be required for the drawdown cone above the mine void to recover to near pre-mining conditions. Total yield would be the same after the mine void reached static conditions, when recharge equaled discharge.

Seepage from the tailings impoundment in any action alternative would alter the quality of ground water in a mixing zone primarily by increasing the concentrations of nitrogen and some metals. Similarly, discharges at the LAD Areas would have similar effects on ground water quality, if not treated. Ground water quality effects would decrease following mining operations as seepage decreased. Some seepage from the tailings facility would continue in perpetuity. The tailings are not anticipated to be acid generating, and the quality of the discharge would remain the same or improve with time. Any permanent change in ground water quality in the tailings impoundment area would be an irreversible commitment of resources.

3.11 Surface Water Hydrology

This section provides information on existing analysis area streams, springs and lakes, and potential consequences to streamflows, spring flows, and lake levels resulting from the mine and transmission line alternatives. Surface water quality is discussed in section 3.12, *Surface Water Quality*.

3.11.1 Regulatory Framework

3.11.1.1 Applicable State Standards

For all state waters, existing and anticipated uses must be maintained and protected. The following uses are prohibited within floodways and floodplains, unless a variance is obtained:

- A structure or excavation that would cause water to be diverted from the established floodway, cause erosion, obstruct the natural flow of water, or reduce the carrying capacity of the floodway
- The construction or permanent storage of objects subject to flotation or movement during flood events (76-5-403, MCA)

For the mine, a variance application must be submitted to the state that provides details on the obstruction or use of a floodway/floodplain and a permit received prior to construction. Approval of a variance is based on the danger to life and property downstream, availability of alternate locations, possible mitigation to reduce the danger, and the permanence of the obstruction or use (76-5-405, MCA). The MFSA directs the DEQ to approve a facility if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impacts considering the state of available technology and the nature and economics of the various alternatives. A floodplain permit would not be needed for the transmission line if a MFSA certificate is approved.

3.11.2 Analysis Area and Methods

3.11.2.1 Analysis Area

The geographic scope of the analysis area includes all areas where surface water may be affected either by mine operations or by installation and maintenance of the transmission line. This area includes the Ramsey Creek, Poorman Creek, Bear Creek, Libby Creek, Miller Creek, West Fisher Creek, Fisher River, Rock Creek and East Fork Bull River watersheds (Figure 76).

3.11.2.2 Baseline Data Collection

Water resource baseline investigations were initiated in the analysis area by U.S. Borax in 1986 and 1987, continued by Noranda in 1988 through 1994 and by MMC in 2004 and 2005 (Geomatrix 2006d). In addition, the DEQ collected water resources information in the CMW in 1998 to 2000, followed by additional surface water data collection in the CMW by MMC in 2005. Streamflow measurements were collected in the analysis area by the KNF between 1960 and 2006. Additional streamflow measurements also were collected by Noranda and MMC from 1998 through 1995 and 2001 through 2005 and by the DEQ in 1998 to 2000. Streamflow monitoring stations are shown on Figure 76. Gaged streamflow sites are on Libby Creek at U.S. 2, West

Fisher Creek, Miller Creek, lower East Fork Bull River, and lower Rock Creek. Four gaged sites also are on the Fisher River. The Northern Region of the Forest Service is conducting a long-term air quality study, which began in 1992, that includes lake chemistry monitoring of Upper and Lower Libby Lakes. Surface water investigations included a review of previous permits and authorizations, existing water use, an analysis of the watersheds potentially impacted by the project, floodplain mapping, streamflow, spring flow, peak streamflow calculations, and surface water quality sampling.

3.11.2.3 Impact Analysis

To determine changes in streamflows, spring flows, and lake levels that may occur during mine construction, operations, and post-mining, MMC's plans for capturing, using, and discharging water within each affected watershed were evaluated. This includes alterations in streamflows and the capture of precipitation and runoff. In addition, because the mine would intercept ground water that may be a source of water to springs, lakes, and streams, the effects to surface water from underground mining also were evaluated.

To determine if mine or transmission line facilities would be located within designated 100-year floodplains, a GIS analysis was completed by overlaying the proposed facilities over the FEMA Q3 flood data for Sanders and Lincoln counties. GIS analysis for the transmission line alternatives included comparing the stream and floodplain crossings required for the mine and transmission line alternatives, providing the watershed acreage for Class 1 and 2 streams where roads would be built or trees cleared for other purposes, and determining the acreages of disturbance for 303(d)-listed streams.

A two-dimensional numerical model of the Montanore mine area was developed to assess mine inflow and changes to base flow (ERO Resources Corp. 2008b). The primary objective of using this model was to establish a hydrogeologic framework that could be used to evaluate potential mine impacts and develop possible impact mitigation. The base flow of the mine area streams was modeled, as was the interaction of stream base flow with the ground water system.

To assess the effects of streamflow changes resulting from a tailings impoundment for each alternative, the agencies analyzed the changes in watershed areas as an indicator of possible streamflow changes (ERO Resources Corp. 2008a in Appendix H). It was assumed that watershed area is directly related to streamflow in the receiving stream of each watershed and that differences in runoff due to elevation, soil type, vegetative cover, slope, and aspect are negligible across the analysis area. Within the small watersheds of the tailings impoundment sites, these differences are likely small. The existing footprints for the tailings impoundments and associated facilities were plotted over the watershed boundaries. Changes to all watersheds were either added or subtracted from the existing watershed area, depending on whether the change would increase or decrease watershed area, and therefore water, to the watershed. Calculations were completed for the three alternatives for operations and post-closure periods. The watershed analysis is presented in Appendix H.

Because of the limited baseline streamflow data available for the analysis area, 7-day, 10-year ($7Q_{10}$) flow, and average annual streamflow were derived for specific stream locations. The $7Q_{10}$ flows were calculated using a USGS method developed for ungaged watersheds (Hortness 2006). The USGS method requires the drainage area and mean annual precipitation to estimate the $7Q_{10}$ flow. The drainage area was calculated from KNF watershed mapping, with small adjustments made for specific locations based on USGS topographic maps. Mean annual precipitation was

estimated using a weighted area average precipitation within the drainage area. Precipitation data were obtained from the Poorman Creek SNOTEL site and PRISM model (Geomatrix 2006d). The $7Q_{10}$ values are presented in section 3.12.2.3.2, *Water Quantity*.

Two USGS gaging stations were operated for many years on Granite Creek (elevation 2,780 feet above mean sea level) and Flower Creek (elevation 2,866 feet above mean sea level), located south of Libby (U.S. Geological Survey 2007). To estimate average monthly flows, the gage data from Granite and Flower creeks were used to derive monthly flow per unit area values, which were then applied to specific locations in the analysis area. Although the Granite and Flower creek watersheds are somewhat different from watersheds in the analysis area, they are the only long-term continuously gaged watersheds near the analysis area and provide the best available information for this evaluation.

The KFP contains water yield guidelines based on instream resource values (Appendix 18, KFP, USDA Forest Service 1987). Forest clearing for roads or other activities often alters normal streamflow dynamics, particularly the volume of peak flows and base flows. The degree to which streamflows change depends on the road density, percentage of total tree cover removed from the watershed, and the amount of soil disturbance caused by the harvest, among other things. For example, if harvest activities remove a high percentage of tree cover and cause light soil disturbance and compaction, rain falling on the soil would infiltrate normally. Due to the loss of tree cover, evapotranspiration (the loss of water by plants to the atmosphere) would be much lower than before. Thus, the combination of normal water infiltration into the soil and decreased uptake of water by tree cover results in higher streamflows. In general, timber clearing on a watershed scale results in water moving more quickly through the watershed (*i.e.*, higher runoff rates and higher peak and base flows) because of decreased soil infiltration and evapotranspiration. Water yield estimates for the analysis area were determined using the KNF beta version of the Equivalent Clearcut Acres Calculator (ECAC) (KNF 2007b). The ECAC Model was designed as a quick-analysis tool to estimate the potential effects of activities such as road, transmission line, and mining disturbances. The ECAC model results are provided in Appendix H.

For lakes and springs, potential changes in lake levels or spring flows were qualitatively evaluated based on changes to the ground water table. Springs located within or downgradient of the footprints of the LAD Areas also were evaluated for changes in flows based on estimated percolation rates to ground water from the LAD Areas. Effects on springs have been discussed in section 3.10.4.2.1, *Mine Area*.

3.11.3 Affected Environment

3.11.3.1 Lakes

Several alpine lakes occur in the analysis area (Figure 76). Many of these lakes are located in glacial cirques that act as collection basins for runoff and snowmelt. Libby Lakes and Isabella Lake are small and lie within closed depressions along the crest of the Cabinet Mountains. Upper Libby Lake is a tributary to the East Fork Rock Creek watershed and Middle and Lower Libby Lakes are tributary to the Libby Creek watershed. Ramsey Lake, a small lake, is in the upper Ramsey Creek watershed. Howard Lake, located near the upper end of Howard Creek, a tributary to Libby Creek, is 33 acres in size and is adjacent to a KNF campground. Howard Lake is located

near the transmission line analysis area. Rock Lake and St. Paul Lake are described, respectively, in the Rock Creek and East Fork Bull River watershed descriptions.

3.11.3.2 Springs

Numerous springs occur in the analysis area and have been discussed in section 3.10, *Ground Water Hydrology*.

3.11.3.3 Streams and Floodplains

Underground mining would occur beneath a divide separating three drainages: East Fork Rock Creek, East Fork Bull River, and Libby Creek. Proposed surface mine facilities in all mine alternatives would be located primarily in the Libby Creek drainage. The area is drained on the east by Libby Creek and its tributaries: Ramsey Creek, Poorman Creek, and Little Cherry Creek (Figure 76). Libby Creek flows north from the analysis area to its confluence with the Kootenai River near Libby. The East Fork Rock Creek flows southwest into the Clark Fork River downstream of Noxon Reservoir. The East Fork Bull River flows northwest into the Bull River.

The transmission line corridor area is drained by the Fisher River and its tributaries: Hunter Creek, Sedlak Creek, Miller and North Fork Miller creeks, Standard Creek, and West Fisher Creek; and by Libby Creek and its tributaries: Howard Creek, Midas Creek, and Ramsey Creek, all perennial streams. Numerous unnamed ephemeral streams also drain the analysis area (Figure 76). One-hundred-year floodplains have been designated along the Fisher River, Miller Creek, an unnamed tributary to Miller Creek, Ramsey Creek, and Libby Creek (Power Engineers, Inc. 2006a).

Snowmelt, rainfall, and ground water discharge are the main sources of supply to streams, lakes, and ponds in the analysis area. Precipitation ranges from 100 inches per year at higher elevations in the Cabinet Mountains to about 30 inches per year at the tailings impoundment site (Geomatrix 2006a). The highest precipitation occurs in November through February and the lowest in July through October.

Base flow is the flow of a perennially flowing stream without any direct surface water runoff; such flow is the result of ground water seepage into the stream channel. During the driest portions of the year when there is no surface runoff either from snowmelt or rain, the only flow in a perennial stream is base flow. Because the near surface geology varies between the upper and lower reaches of streams in the project area, the source of ground water to streams also varies. In the upper reaches, there is little if any alluvium or colluvium and very little, if any, weathered bedrock. Therefore, the primary source of ground water to in the upper stream reaches is fractured bedrock. The thickness of the unconsolidated surficial deposits and weathered bedrock that may contribute ground water to streams increases in a downstream direction. Because the fractured bedrock is hydraulically connected to the weathered bedrock and surficial deposits, it is difficult to separate the individual sources of ground water flow to streams in the middle and lower reaches of the drainages. It is likely that base flow in the lower reaches is dominated by ground water flow from the thicker surficial deposits. During the year, there is probably an ever-changing ratio between shallow ground water (from the surficial deposits and weathered bedrock) and deeper bedrock ground water contributions to any one stream. Project area streams do not reach base flow every year.

3.11.3.3.1 Watershed Descriptions

Libby Creek

Libby Creek is the primary watershed within the analysis area. Libby Creek flows northward and joins the Kootenai River near the town of Libby. Its entire 29-mile length is rated as outstanding (Class 1) for fisheries habitat by the FWP (FWP 2008a). Within the analysis area, the primary tributaries to Libby Creek are Ramsey, Poorman, Little Cherry, and Bear creeks (Figure 76). Libby Creek originates in a steep, glacial-carved basin at an elevation of 5,600 feet, and discharges to the Kootenai River 29 miles downstream at an elevation of about 2,000 feet. Libby Creek drains an area of about 68 square miles upstream of where the stream crosses U.S. 2. The uppermost reach of Libby Creek is intermittent and restricted to a narrow canyon channel flowing across bedrock or coarse valley-fill and glacial deposits. The Libby Creek valley widens downstream, where more erodible alluvial, glaciolacustrine, and glaciofluvial deposits are encountered. In these lower reaches, Libby Creek is perennial, with flow sustained by ground water discharge. Libby Creek is the only stream in the mine area that has a well-developed floodplain. Libby Creek is a large, third-order stream near the proposed mine facilities. It is primarily restricted to a narrow channel flowing through bedrock canyons, erodible valley fill material, and glaciolacustrine sediment. Unstable stream channel characteristics in the Libby Creek drainage can be attributed, in part, to historic placer mining by hand (late 1800s), hydraulic and dredge mining (early to mid-1900s), and logging/clearcutting (early to mid-1900s).

Ramsey Creek

Ramsey Creek originates at an elevation of 4,400 feet and discharges to Libby Creek 5.3 miles downstream, at an elevation of 3,425 feet. Its entire length is rated as outstanding (Class 1) for fisheries habitat by the FWP. The total drainage area for Ramsey Creek is about 6.5 square miles. The upper watershed is poorly drained and contains both a marshy area and Ramsey Lake, a small lake of about 2 acres (Figure 76). Water in the marsh flows through a series of ponds and meanders through grassy, wet meadows. Downstream of the meadows, Ramsey Creek is a high-energy stream flowing through a series of narrow bedrock canyons and glacial moraine material. Ramsey Creek is a perennial stream with heavily forested banks. Near the proposed mine facilities, Ramsey Creek is a second order stream.

Poorman Creek

Poorman Creek originates at an elevation of 5,400 feet and joins Libby Creek 5.3 miles downstream, at an elevation of 3,315 feet. Its entire length is rated as outstanding (Class 1) for fisheries habitat by the FWP. The drainage area is about 6 square miles. Poorman Creek is a small, perennial stream located south of the Poorman Tailings Impoundment Site and north of the LAD Areas. Near the proposed mine facilities, Poorman Creek is a second order stream. The creek flows in a narrow, straight channel with several small intermittent tributaries, heavily forested banks, and a boulder, cobble, and gravel bed. Streamflow is relatively constant both upstream and downstream.

Little Cherry Creek

Little Cherry Creek is a perennial stream originating on the lower slopes of the Cabinet Mountains at an elevation of about 4,100 feet. It drains about 1.9 square miles, and flows 3.1 miles to its confluence with Libby Creek. Its entire length is rated as outstanding (Class 1) for fisheries habitat by the FWP. Streambed material ranges from boulders to sand and silt. Little Cherry Creek is incised into glaciolacustrine and glaciofluvial sediment, with a steep gradient

reach where bedrock outcrops in the lower section near its confluence with Libby Creek. Little Cherry Creek gains water from ground water discharges throughout its length (USDA Forest Service 2008a). Near the Little Cherry Creek tailings impoundment, Little Cherry Creek is a second order stream.

The upper portion of the watershed is forested and the lower portion has been logged. In logged areas, stream banks are collapsed, and small shrubs and forbs have become established. The average bankfull width of upper Little Cherry Creek is 8 feet and in the lower creek is 14 feet. Bankfull width is the width of the stream when carrying the 1.5- to 2-year peak flow (Rosgen 1996).

Bear Creek

Bear Creek is the largest tributary of Libby Creek in the analysis area, draining a 15-square mile area. Originating in a glacial basin at an elevation of about 7,100 feet, Bear Creek flows perennially 8.2 miles, converging with Libby Creek at an elevation of 3,050 feet. Its entire length is rated as outstanding (Class 1) for fisheries habitat by the FWP. Bear Creek is incised into lake bed (glaciolacustrine) silt, although small areas of exposed bedrock occur in portions of the channel area. Most of the watershed is heavily forested. The streambed material is composed primarily of cobbles and gravels.

Rock Creek and Rock Lake

Rock Creek is formed by the convergence of the east and west forks of the creek, which drain an area of about 33 square miles of steep, high-elevation terrain. Underground mining would occur under the headwaters of the East Fork Rock Creek. The 5.6 miles of the East Fork Rock Creek is rated as limited (Class 6) for fisheries habitat by the FWP. Below the confluence of the east and west forks of the creek, Rock Creek is rated as moderate (Class 4) for fisheries habitat.

The headwaters of the East Fork Rock Creek are above Rock Lake. During periods when there is no snow in the East Fork Rock Creek basin and there has been no recent precipitation, the only source of water to the upper creek and Rock Lake is deep bedrock ground water (see section 3.10.3.1, *Bedrock Hydrogeology*). Below Rock Lake at Rock Creek Meadows shallow ground water also becomes a source of supply to the East Fork Rock Creek.

Rock Lake, at an elevation of 4,958 feet, has a 1.1 square mile watershed, a 58-acre surface area, a mean depth of 30 feet, and a maximum depth of 70 feet. Rock Lake is fed by a short perennial stream and the source is snowmelt during the spring and early summer, as well as ground water throughout the year (Gurrieri 2001). Rock Lake is located along the Rock Lake Fault. The residence time of the lake water is very short during the spring snowmelt period (a few days), and lengthens significantly later in the year. The lake is a flow-through system—the lake gains surface and ground water from the area above it and loses water via evaporation, a surface outlet and, presumably, to ground water to the area below it, most likely via bedrock fractures. Stage changes in Rock Lake were measured from mid-July through mid-October in 1999; the total decrease in lake level during that time was 11 inches (Gurrieri 2001).

East Fork Bull River and St. Paul Lake

The East Fork Bull River has several tributaries that drain an area of about 26 square miles of the CMW. Its entire length is rated as outstanding (Class 1) for fisheries habitat by the FWP. During periods when there is no snow in the East Fork Bull River basin and there has been no recent precipitation, the only source of water to the uppermost part of the drainage (above St. Paul Lake)

may be deep bedrock ground water. Spring SP-32, located above St. Paul Lake, has not been confirmed to flow during a late summer base flow period, so it is uncertain whether this spring contributes water to St. Paul Lake during the late summer season.

St. Paul Lake, elevation 4,715 feet, has a 9-acre surface area, and is located along the Rock Lake Fault near the top of the watershed. An area of about 1.5 square miles drains into St. Paul Lake. The lake is dammed by glacial moraine material, and outflow from the lake is through the glacial gravels to a small pond located a few hundred feet downstream and eventually to the East Fork Bull River drainage. Seasonal stage changes have not been measured in St. Paul Lake, but the lake level has been observed to fluctuate to a much greater extent than does Rock Lake due to leakage through the relatively high permeability morainal material (Gurrieri, pers. comm. 2008). St. Paul Lake has been observed to completely dry during extended periods of little to no precipitation.

Howard Creek and Howard Lake

Howard Creek is a tributary to Libby Creek. Howard Lake is located near the headwaters of Howard Creek at an elevation of 4,100 feet and is 33 acres in size. All of the transmission line alternatives would cross lower Howard Creek and two of the transmission line alternatives would cross upper Howard Creek at its headwaters. The drainage area is about 2.3 square miles, and the watershed begins at about 5,380 feet. The creek is about 2.8 miles long. The entire length of Howard Creek is rated as outstanding (Class 1) for fisheries habitat by the FWP.

Midas Creek

Midas Creek is a tributary to Libby Creek that flows from the southeast into Libby Creek a short distance downstream of Poorman Creek. The North Miller and Modified North Miller transmission line alternatives would cross upper Midas Creek. The drainage area is about 6 square miles, and the watershed begins at about 5,750 feet. The creek is about 3.3 miles long. The entire length of Midas Creek is rated as outstanding (Class 1) for fisheries habitat by the FWP.

Miller Creek

Miller Creek is a tributary to the Fisher River located southeast of the mine area. Three transmission line alignment alternatives follow Miller Creek for about 2 miles immediately west of U.S. 2. The drainage area is about 12 square miles; the watershed is relatively low, starting at about 5,600 feet in elevation. Its entire 6.2-mile length is rated as moderate (Class 4) for fisheries habitat by the FWP. The transmission line alignment in Alternatives B and C would parallel an unnamed tributary to Miller Creek that flows from the north into Miller Creek. The drainage area of this tributary is 1.9 square miles, the top of the watershed begins at about 5,400 feet, and the length of the tributary is about 2.4 miles.

West Fisher Creek

West Fisher Creek is also located southeast of the mine area. The West Fisher Creek transmission line alignment generally parallels the creek for about 5 miles. It has a large drainage area (44 square miles) that originates at about 7,500 feet in the CMW. The creek has several lakes in its headwaters and numerous tributaries. Its entire 13.3-mile length is rated as moderate (Class 4) for fisheries habitat by the FWP.

Fisher River

The Fisher River is a tributary to the Kootenai River. The river is formed by two tributaries, Silver Butte Fisher River and Pleasant Valley Fisher River. Miller Creek and West Fisher Creek

flow into the river 3 to 4 miles below the confluence of the two tributaries. The river is 63 miles long and has a watershed area of 838 square miles. In the analysis area, the river is rated as substantial (Class 3) for fisheries habitat.

Hunter Creek

Hunter Creek has a small drainage area (1.64 square miles) that originates east of U.S. 2. All transmission line alternatives except the West Fisher Creek alignment cross the creek. Most of the watershed is on Plum Creek lands. Hunter Creek's 2-mile length is rated as moderate (Class 4) for fisheries habitat by the FWP.

Sedlak Creek

The Sedlak Creek watershed is immediately south of Hunter Creek. Sedlak Creek flows into the Pleasant Valley Fisher River about 1,000 feet east of the proposed Sedlak Park Substation Site. Preliminary design indicates all transmission line alternatives except Alternative B would span across a bend in the creek; it may be possible to avoid spanning the creek during final design. Sedlak Creek has a small drainage area (1.04 square miles) that originates at an elevation of 4,200 feet. Most of the watershed is on Plum Creek lands. Sedlak Creek's 2-mile length is rated as moderate (Class 4) for fisheries habitat by the FWP.

Standard Creek

Standard Creek, a tributary to West Fisher Creek and the Fisher River, drains a portion of the transmission line corridor area, but would not be affected by the mine or by construction and maintenance of the transmission line. Short segments of the Miller and West Fisher Creek transmission line alternatives would be within the Standard Creek watershed, but the line and any associated access roads would be located more than 1 mile from the creek. The agencies expect that Standard Creek would not be affected, and it is not discussed further.

3.11.3.3.2 Streamflow

None of the streams within the analysis area have been continuously gaged on a long-term basis, but flows have been occasionally measured, mostly at lower elevations and nearly all outside of the CMW. In all of the streams measured (Libby Creek, Ramsey Creek, Poorman Creek, Little Cherry Creek, Bear Creek, Miller Creek, West Fisher Creek, Rock Creek, and the East Fork Bull River), the highest flows occur annually between April and June, with the highest flows most often occurring in May, then secondly in April. There are typically smaller, short-term increases in streamflows in October through March due to precipitation and snowmelt events. Base flows occur most often from mid-August to mid-September, but may occur for up to 2 months during late summer to early fall and also may occur during November through March. Streamflow in the analysis area were often not measured during November through February. Highest and lowest measured flows are provided for each stream in Table 84.

The area is sometimes subjected to strong warm-frontal storms during the winter months that bring heavy rain, warm temperatures, and strong winds. Depending on storm intensity and soil and snowpack moisture conditions, these storms can produce very high streamflows. For example, in December 2004, the KNF measured a flow of 560 cfs at the West Fisher Creek site. This flow, equivalent to the highest flow measured at this site in June 2006, was due to a rain-on-snow event. Rain-on-snow events occur about every 6 years (Wegner, pers. comm. 2006c). In addition to causing high streamflows, the high rate of water input to the soil can generate unstable

conditions on hill slopes. During such high flows, landslides can occur and stream channels may be altered by bank erosion, down cutting, and redistribution of sediment and large woody debris.

Table 84. Measured High and Low Flows in Analysis Area Streams.

Stream	Station	Sampling Period	Minimum Streamflow (cfs)	Maximum Streamflow (cfs)	Number of Measurements
Libby Creek	LB-100	4/88 to 10/88	1.1	50.7	9
	LB-200	4/88 to 10/94	1.2	113	35
	LB-300	9/89 to 6/05	1.6	148	32
	LB-500	4/88 to 9/89	1.0	173	22
	LB-800	4/88 to 6/03	2.9	250	34
	LB-1000	2/91 to 10/94	2.9	77.5[1]	15
	LB-2000	4/88 to 10/93	5.8	204	27
	LB-3000	4/88 to 10/93	10.6	319	Numerous[2]
	U.S. 2	3/99 to 8/08	4.0	1,076	44
Ramsey Creek	RA-100	4/88 to 10/93	0	60.9	18
	RA-200	4/88 to 10/93	0.5	62.8	24
	RA-600	4/88 to 5/05	1.2	119.5	35
Poorman Creek	PM-500	4/88 to 10/93	0.5	85.4	24
	PM-1000	4/88 to 6/05	0.7	62	30
Little Cherry Creek	LC-100	4/63 to 9/65 and 4/88 to 6/05	0.1	15	60
	LC-USFS	4/63 to 9/65	0.2	15	30
	LC-600	4/88 to 6/05	0.2	13.2	12
	LC-800	4/91 to 6/05	0.2	9.7	12
Bear Creek	BC-100	4/88 to 10/88	1.8	98.1	9
	BC-USFS	11/60 to 9/65	5.0	230	31
	BC-500	4/91 to 6/05	2.8	101	13
East Fork Rock Creek	EF-200	10/78 to 9/05	0.8	15.3	8
	EF-300	9/88 to 10/88	0.4	6.5	2
	Upper Rock Ck	12/74 to 8/84	1.7	252	21
East Fork Bull River	Lower EF Bull River	12/74 to 6/00	4.6	522	83
Miller Creek	Miller Ck	5/78 to 4/82	10.6	63.5	3
West Fisher Creek	West Fisher Ck	10/01 to 8/08	8.6	669	34

[1] LB-1000 not measured during peak spring runoff.
[2] LB-3000 flow measured with a continuous recorder in 1988 and 1989.
Station locations are shown on Figure 76.
cfs = cubic feet per second.
Source: Geomatrix 2006d; Neesvig, pers. comm. 2006; Wegner, pers. comm. 2006d.

Over the past 20 years, rain-on-snow events occurred in the KNF in 1990, during the fall and winter of 1995-96 and in 2005. These events caused extensive damage to road drainage and stream crossing structures throughout the KNF. Channel alterations caused by ice flows associated with these events occurred to most stream systems in the Libby Ranger District and resulted in streambed scouring. The rain-on-snow event that occurred in February 1996 resulted in down cutting of most perennial channels by about 2 to 3 inches.

For some of the higher-elevation gages within the analysis area, the lowest flows measured (August and September for Libby and Ramsey creeks, September and October for East Fork Rock Creek) are provided in Table 85. It is unknown whether the flows provided in this table represent base flows for these locations.

Table 85. Low Flows Measured at Three Stream Locations in Analysis Area.

Stream	Station	Number of Measurements	Range of Flows (cfs)	Average Low Flow (cfs)	Median Low Flow (cfs)
Libby Creek	LB-300	6	1.6 to 8	3.9	3.8
Ramsey Creek	RA-200	4	0.5 to 1.7	1.2	1.2
East Fork Rock Creek	EF-200	3	0.8 to 2.2	1.6	1.8

Station locations shown on Figure 76.
cfs = cubic feet per second.
Source: Geomatrix 2006d; Neesvig, pers. comm. 2006.

MMC completed synoptic flow measurements in late August 2005 at selected locations along Ramsey Creek, Poorman Creek, Little Cherry Creek, and Libby Creek (Table 86). These data indicate that the three tributaries to Libby Creek are gaining streams, with inflow from ground water (although some of the Little Cherry Creek measurements do not suggest this). Some of the flow in Libby Creek between stations LB-500 and LB-800 apparently infiltrates to the subsurface, because the increase in flow from 1.6 to 2.8 cfs does not account for the 2.8 cfs coming in from Ramsey Creek (RA-600) and unknown flow from Howard Creek. Libby Creek below LB-800 apparently gains some flow from ground water.

3.11.3.4 Little Cherry Creek Tailings Impoundment Site Stream Channel Characteristics

At the Little Cherry Creek Tailings Impoundment Site, the Little Cherry Creek channel substrate material is predominantly gravel. Channel bankfull width is about 9 feet and the maximum bankfull depth is 0.7 to 1.2 feet. The flood-prone width ranges from 13 to 17 feet. The channel gradient near LC-1 (Figure 76) is 4 percent. The channel is stable, and the stream contains pools and riffles. Bedrock outcrops in the channel downstream of the Seepage Collection Dam Site.

Using the best available information (unit area average flows for Granite and Flower creeks, USGS gaged streams located near Libby), mean monthly and annual flows were calculated for Little Cherry Creek at the upgradient end (LC-100, elevation 3,720 feet above mean sea level) and downgradient end (LC-600, elevation 3,380 feet above mean sea level) of the proposed Little Cherry Creek Tailings Impoundment (Table 87).

Table 86. Synoptic Streamflow Measurements.

Ramsey Creek	Poorman Creek	Little Cherry Creek	Libby Creek
RA-1 = 1.79	PM-500 = 1.07	LC-100 = 0.16	LB-500 = 1.55
RA-2 = 1.93	PM-1 = 0.76	LC-1 = 0.17	LB-800 = 2.82
RA-3 = 2.26	PM-2 = 1.03		LB-2000 = 8.86
RA-4 = 2.34	PM-3 = 1.5	LC-100 = 0.11*	
RA-600 = 2.79	PM-4 = 0.91	LC-1 = 0.33*	
	PM-1000 = 0.77	LC-800 = 1.82*	
	PM-5 = 1.93		
		LC-1 = 0.37**	
		LC-800 = 0.31**	

All flows are in cubic feet per second.
Station locations are shown on Figure 76.
Measurements made August 24–26, 2005, except data with (*) measured June 25–26, 2005 or data with (**) measured July 30–31, 2005.
Source: Geomatrix 2006d.

Table 87. Calculated Mean Monthly, Annual, and Unit Area Flows for Little Cherry Creek.

Little Cherry Creek at Downgradient End of Little Cherry Creek Tailings Impoundment near Station LC-600 (drainage area = 2.2 mi^2)												
Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual or Monthly Average
1.85	2.07	2.49	8.54	19.2	19.1	6.25	2.05	1.69	2.18	2.79	2.84	5.96
Little Cherry Creek at Upgradient End of Proposed Tailings Impoundment near Station LC-100 (drainage area = 0.9 mi^2)												
0.76	0.85	1.02	3.49	7.86	7.82	2.56	0.84	0.69	0.89	1.14	1.16	2.44

Station locations shown on Figure 76. Units are cubic feet per second based on drainage areas calculated by Geomatrix (2006a).

3.11.3.5 Poorman Tailings Impoundment Site Stream Channel Characteristics

Four channels in the alternate Poorman Tailings Impoundment Site flow east toward Libby Creek (Figure 26). Channel A begins east of Little Cherry Creek and flows toward Libby Creek. Channel B and two other channels join just west of Libby Creek and then flow toward Libby Creek. Little Cherry Creek would be diverted into the northern two channels (Channels A and B) in Alternatives 2 and 4. The four channels are stable and have only intermittent flows that have not been measured. Between the lower Libby Creek floodplain and NFS road #1401, for a reach of about 1,000 feet, Channel A has a low gradient (3.5 percent), except for a short segment where it drops abruptly into the Libby Creek floodplain. No channel is present and surface flow is dispersed in an unconfined reach of grass and alder. The next reach of about 2,000 feet is steep (9 to 15 percent) with a moderately defined channel. The uppermost 3,200 feet consists of a well-defined, low to moderate gradient (3 to 6 percent) channel with gravel and small cobbles. The bankfull width is about 2 feet (Geomatrix 2006b). Channel B is mostly a vegetated depressional

drainage with only very small portions that are scoured channel. Channel B has a shallow gradient and does not connect directly to Libby Creek. Flow in the Channel B is infrequent and most of the water infiltrates into the ground. The two southernmost channels start at a wide, flat topographical bench and drain off the snow pack. Of the four channels, flow in the southernmost channel is perennial; the other three channels have perennial segments, and are intermittent in the lower segments near Libby Creek (Corps 2008).

3.11.4 Environmental Consequences

3.11.4.1 Alternative 1 – No Mine

Under this alternative, MMC would not develop the Montanore Mine. Any existing exploration-related or baseline collection disturbances by MMC would be reclaimed in accordance with existing laws and permits. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Without the mine, stream and spring flows, as well as lake levels, would be unchanged from existing conditions.

3.11.4.2 Alternative 2 – MMC Proposed Mine

In MMC's proposal, the mill and production adits would be located in the upper Ramsey Creek drainage, about 0.5 mile from the CMW boundary (Figure 3). An additional adit on MMC's private land in the Libby Creek drainage and a ventilation adit on MMC's private land east of Rock Lake would be used for ventilation. A tailings impoundment would be constructed in the Little Cherry Creek drainage, and would require the diversion of Little Cherry Creek. Two LAD Areas between Poorman Creek and Ramsey Creek are proposed to allow for wastewater discharge using sprinklers during the growing season. A portion of the waste rock produced by driving the adits may be stored temporarily at LAD Area 1, and at the Libby Adit Site, before use in construction.

3.11.4.2.1 Effects of Inflows During Construction and Mining

Conceptual Model of Surface and Ground Water Connection

MMC's and the agencies' conceptual models of the Montanore mine area hydrogeology are described in section 3.10.3.1, *Bedrock Hydrogeology*. The agencies' conceptual model, which is considered more conservative and was used for the EIS analysis, is that springs and streams that exist above an elevation of about 5,600 feet are not hydraulically connected to deeper bedrock ground water and are supported by surface runoff and/or infiltration of precipitation into thin, unconsolidated, discontinuous surface deposits. Springs and streams located below this elevation are supplied by surface runoff, shallow ground water, and ground water in deeper bedrock fractures that intersect the ground surface.

Numerical Model of Surface and Ground Water Connection

The agencies' numerical model of the Montanore mine area predicted that ground water drawdown would occur as a result of mine dewatering. The model also predicted that about 450 gpm of water would be produced on a steady state basis from the mine and adits at full buildout. Because ground water is one of the sources of supply to mine area streams, the model predicted that ground water contribution to mine area streams would be reduced by an amount equivalent to the water produced as a result of mine dewatering. The agencies' numerical model predicts that

affected streams would be Ramsey Creek, Libby Creek, East Fork Rock Creek, and the East Fork Bull River. Estimated changes to the base flows of these streams are provided in the *Hydrogeology Technical Report* (ERO 2008b) and discussed in section 3.10.4.2.1, *Mine Area*. About 60 percent of the model-predicted flow reductions that would occur during mining would be in the East Fork Bull River and Rock Creek drainages west of the divide and 40 percent would be in the Libby Creek watershed east of the divide. If the ground water flow system were controlled by structural trends, reduction in base flow may be focused in one or more of the drainages along structural trends, rather than being distributed as predicted by the model.

Changes in Base Flow

Changes to the base flow of area streams as a result of mining may occur where stream channels intercept bedrock fractures that provide base flows to the streams. The change in base flow at the highest elevations on Ramsey Creek, Libby Creek, East Fork Rock Creek, and the East Fork Bull River may be manifested as a change in elevation at which the streams become perennial. Changes in base flow would most likely be detected during the driest portions of the year when there is no surface runoff, which is typically mid-August to mid-September, but could occur for longer periods in late summer to early fall and in the winter. Changes at some locations may not be measurable or even detectable for several reasons. First, it is difficult to measure streamflow in the mine area using a streamflow meter to an accuracy greater than plus or minus 10 percent (Wegner, pers. comm. 2007). Second, the base flow of a stream may change over time due to climatic variability. The elevation at which the streams become perennial may change from year-to-year based on seasonal precipitation. Third, available base flow data within the analysis area are lacking, particularly in higher elevation stream segments. Given the natural variability of base flows, it would likely be necessary to collect stream base flow data for a number of years to be able to compare to flow data collected during mining.

Libby Creek. The agencies' numerical model predicts a decrease during mining in the base flow of Libby Creek within and downstream of the CMW. The flow changes would be difficult to measure, particularly in the lower reaches where base flow increases substantially. In addition, changes in base flow due to mine operations would be difficult to separate from the natural variability of base flow, which has not been measured in the analysis area.

Ramsey Creek. The agencies' numerical model predicts a base flow reduction during mining within and downstream of the CMW. These flow changes would be difficult to measure. In addition, changes in base flow due to mine operations would be difficult to separate from the natural variability of base flow, which has not been measured in the creek.

East Fork Rock Creek. The agencies' numerical model predicts that the base flow of East Fork Rock Creek would be reduced due to mine dewatering. The predicted changes in base flow may be small relative to typical flow in the creek during much of the year. During the September 2007 agency site review, it was apparent that when there is no snow above Rock Lake and there has been no recent precipitation, the only source of surface inflow to Rock Lake is a bedrock spring (SP-31) located above Rock Lake where the Rock Lake fault intercepts East Fork Rock Creek. Changes in base flow in East Fork Rock Creek above Rock Creek Meadows due to mine operations may be measurable during periods similar to September 2007 (base flow periods with little or no snowmelt and dry weather) and may reduce inflow and outflow from Rock Lake. Below Rock Creek Meadows. It may be difficult to separate possible impacts due to mine dewatering from the natural variability of base flow. Changes in base flow at and below Rock

Creek Meadows may be masked by ground water stored in thick alluvium along the middle and lower reaches of East Fork Rock Creek.

East Fork Bull River. The agencies' numerical model predicts a reduction in base flow during mining. The same situation may occur in the upper East Fork Bull River drainage as described above for the upper East Fork Rock Creek drainage. The KNF and DEQ reported spring discharge in a drainage above St. Paul Lake near the trace of the Rock Lake fault in September 2006 at an elevation of about 4,500 feet (McKay 2007). It is not known if the sources of water to this spring (SP-32) are deep ground water and/or discharge from a shallow ground water system. During average to dry years, deeper ground water discharge, assuming such a flow path exists, may be the only source of water to St. Paul Lake when there is no snow above the lake and there has been no recent precipitation. During such periods, the estimated reduction in base flow in the upper reaches of the East Fork Bull River above and below St. Paul Lake as a result of mine dewatering may be measurable. Due to the thick sequences of glacial material located beneath and downstream of St. Paul Lake, it may not be possible to detect such base flow reductions below St. Paul Lake. No flow data are available for the East Fork Bull River within the CMW.

Impacts to Lakes

Because the Libby Lakes are at an elevation of about 7,000 feet, perched above the ground water table, they likely would not be affected by mining activities. Howard Lake is located at an elevation of 4,100 feet, but would be too far from mining activities to be affected by the project. Ramsey Lake, located near the proposed Ramsey Plant Site and the Ramsey Adits, is at an elevation of about 4,450 feet. Ramsey Lake is fed mostly by snowmelt and water flowing in shallow surface deposits in the Ramsey Creek drainage (Wegner, pers. comm. 2008). The lake level varies substantially in Ramsey Lake and it is unlikely that changes in the lake level due to mining would be detectable. In the agencies' conceptual model, Rock Lake is hydraulically connected to the deep bedrock ground water table and is within the area of predicted drawdown during mining. A connection between the deep bedrock ground water system and St. Paul Lake is unknown, but it is possible that spring SP-32 and other springs upgradient of St. Paul Lake below 5,600 feet could be influenced by mining. Due to limited baseline lake level data and water balances for the two lakes, it was not possible to quantify potential changes in lake levels due to mining. The ground water model predicted a decrease in the base flows that contribute to inflows to both lakes and are the only source of inflows during dry periods. Such changes in inflows may result in measurable changes in lake levels only during periods when deep ground water is the only source of water to the lakes (when there is no snowpack above the lakes and no precipitation in the watersheds above the lakes). After additional baseline lake levels are collected to determine the pre-mining variability in the level of Rock Lake, it may be possible to determine if changes in lake level due to mining are separable from natural lake level variability. St. Paul Lake may not be affected similarly by mining because of its location within morainal material, which causes the lake level to fluctuate to a much greater extent than does Rock Lake.

MMC would monitor lake levels in Rock Lake (see section 2.4.5.1, *Hydrology*) and develop a water budget for Rock Lake to determine if mine dewatering affected Rock Lake. MMC would implement monitoring at Rock Lake to measure lake levels that would allow subsequent detection of small changes in lake levels due to possible dewatering effects of the project. Water budget variables would be measured or estimated, including evaporation, precipitation, surface water inflows and outflows, ground water inflows and outflows, and continuous lake levels. The lake monitoring system design and evaluation would be coordinated with the lead agencies.

3.11.4.2.2 *Effects of Timber Clearing on Peak Streamflows*

The KNF's ECAC model results (KNF 2007b) indicates timber clearing in Alternative 2 may measurably increase the peak flow of Ramsey Creek (Appendix H). The increase in Ramsey Creek peak flow was estimated to be 8 percent. Increased peak flows in other streams would not be measurable.

3.11.4.2.3 *Effects of New Road Crossings on Streamflows and Floodplains*

Alternative 2 would require three new road crossings across major streams and one new road crossing across a minor stream (Table 88). New roads would cross less than 0.1 acre of floodplain. During construction, disturbances within the floodplain would be minimized. New bridges are proposed over Ramsey and Poorman creeks and a culvert would likely be installed in Little Cherry Creek above the Diversion Dam. After construction is completed, the bridges and culvert would not affect natural streamflows. Table 88 provides information on stream crossings and floodplains that may be affected by the combination of Alternative 2 for the mine and Alternative B for the transmission line.

Table 88. Comparison of Stream and Floodplain Crossings Required for Mine and Transmission Line Alternatives.

Alternative or Combination of Alternatives	Number of Stream Crossings by New Roads		Acres of Flood-plain Crossed	Acres of New Roads within Designated Floodplain	Number of Stream Crossings by Transmission Line	
	Major Stream	Minor Stream			Major Stream	Minor Stream
Mine Alternatives						
2	3	1	<0.1	0	-	-
3	1	1	2.3	0	-	-
4	2	1	0.0	0	-	-
Transmission Line Alternatives						
B	1	4	1.1	1.6	6	16
C	0	3	0.3	0.5	6	13
D	0	5	0.3	0.6	8	13
E	0	4	0.3	<0.1	9	13
Combined Mine and Transmission Line Alternatives						
2 and B	4	5	1.1	1.6	6	16
3 and C	1	4	2.6	0.5	6	13
3 and D	1	6	2.6	0.6	8	13
3 and E	1	5	2.6	<0.1	9	13
4 and C	2	4	0.3	0.5	6	13
4 and D	2	6	0.3	0.6	8	13
4 and E	2	5	0.3	<0.1	9	13

Source: GIS analysis by ERO Resources Corp. using KNF data.

3.11.4.2.4 Effects of Discharges during Construction and Operations

During construction, operations, and post-mining, several analysis area streams would receive additional water from mine-related discharges. Ramsey Creek would receive mine drainage stormwater from the Ramsey Plant Site and Poorman Creek would receive mine drainage stormwater from the Waste Rock Stockpile from storms greater than the 10-year/24-hour storm (estimated to be 2.4 inches). When the LAD Areas were used, Ramsey and Poorman creeks also would receive stormwater from the LAD Areas except from storms less than the 10-year/24-hour storm. MMC's stormwater retention structures would retain stormwater from the 10-year/24-hour storm.

Pumpback wells would intercept all seepage not collected by the underdrain system, so no seepage water would flow from the tailings impoundment to surface water. Mine and adit water discharged at the LAD Areas would first pass through soils underlying the LAD Areas, and then mix with underlying ground water. This time in residence would dampen any sudden increases in streamflows due to this additional water. Ground water beneath the LAD Areas flows to either Ramsey, Poorman, or Libby creeks.

MMC proposes to use slow rate land application for primary treatment of wastewater (MMI 2005a; Geomatrix 2007a; MMC 2008). Land application is the uniform application (usually with sprinklers) of wastewater (for the Montanore Project, mine water not needed for operations) to a vegetated soil surface, with no runoff. The discharged water can receive significant treatment as it flows through the plant root/soil matrix (Environmental Protection Agency 2006b). Water discharged to the LAD Areas would either evapotranspire or percolate to ground water. Water that percolated to ground water would flow downgradient to the nearest stream. MMC has estimated that up to 534 gpm of water would be treated by land application before the water entered nearby streams. MMC anticipates that land application would occur only during the 6-month growing season.

Table 89 provides the Alternative 2 sources and estimated quantities of water to receiving streams, monitoring sites, and the agencies' expected discharge rates to ground water beneath the LAD Areas and the Little Cherry Creek Tailings Impoundment. For the 200-acre LAD Areas in Alternative 2, the estimated maximum application rate at the LAD Areas would be about 130 gpm (see section 3.12.2.3, *Impact Analysis* and section 3.10.4.2.3, *LAD Areas* for further discussion). Based on the agencies' analysis, application rates in excess of 130 gpm to the 200-acre LAD Areas would likely result in surface runoff or the creation of springs in and downgradient of the LAD Areas. The estimated maximum discharge rates to receiving waters provided in Table 89 would be the same during construction, operations, and post-mining. The maximum application rate would depend on site conditions, and would be determined on a performance basis by monitoring both water quality and quantity changes. It is likely that monitoring would determine that the maximum application rate could be higher or lower than estimated by the agencies' analysis. The application rate would be adjusted to meet effluent limits set for discharges at the LAD Areas and to prevent the development of springs in or downgradient of the LAD sites.

The discharges to mine area streams from the LAD Areas would be small, would occur as increased ground water seepage to the stream channels, and would likely not be noticeable even during low flows. The largest percent flow increase (not considering Little Cherry Creek, whose flow would be altered by the tailings impoundment) would be to Ramsey Creek, where the inflow of 14 gpm (0.03 cfs) would be about 2 percent of the $7Q_{10}$ flow (1.4 cfs, see section 3.12.2.3,

Impact Analysis). Surface runoff resulting from storm events would occur with or without the project, but in Alternative 2, runoff from the LAD Areas and Waste Rock Stockpile would be captured in an unlined stormwater retention pond, discharged through an overflow pipe, and then flow overland about 1,500 feet to Poorman Creek. Runoff from the Ramsey Plant Site fill slope would be captured at the toe of the fill, and conveyed through a ditch to a sediment trap and then released overland about 150 feet to Ramsey Creek.

Table 89. Wastewater Sources to Receiving Streams and/or Ground Water and Estimated Maximum Discharge Rates during Construction, Mining, and Post-Mining, Alternative 2.

Water Route and Source	Receiving Stream/ Monitoring Site	Estimated Maximum Discharge Rate (gpm)
Estimated Discharge from LAD Areas to Streams		
Percolation to ground water from LAD Area 1	Ramsey Creek/RA-400	14
Percolation to ground water from LAD Area 2	Ramsey Creek/RA-600	4
	Poorman Creek/PM-1200	9
	Libby Creek/LB-800	5
Stormwater Runoff Subject to Effluent Limitations Guidelines (ELGs) in Streams		
Surface runoff of mine drainage from LAD Areas and Waste Rock Stockpile when exceeds 10-year/24-hour storm event (retention pond capacity)	Poorman Creek/PM-1200	Storm dependent
Surface runoff of mine drainage from plant site when exceeds 10-year/24-hour storm event (retention pond capacity)	Ramsey Creek/RA-200	Storm dependent

The monitoring site listed for each wastewater source is one of many that would be included in a comprehensive monitoring program (see Appendix C for the agencies' proposed surface water, ground water, and aquatic life monitoring).

The percolation rate from the unlined LAD Area stormwater retention pond, based on a 4-acre estimated pond area and Geomatrix's (2007a) long-term infiltration and permeameter tests for the LAD Areas, would be about 230 gpm, assuming that the bottom of the pond is flat and the entire 4 acres is wetted, but no measurable depth has accumulated. If the pond were to fill, the percolation rate would potentially be much higher because of the higher hydraulic head. However, the maximum percolation rate would be limited by how fast ground water could be conveyed away from the retention pond as a ground water mound develops beneath the pond. Assuming that the LAD Area upgradient of the retention pond was being used at or near its maximum capacity, any additional contribution of water to the ground water table via the unlined stormwater retention pond or unlined channel would likely result in ground water discharge in the form of springs to the surface. When the unlined retention pond contained or received water, the application rate to the LAD Area would have to be reduced to account for this additional contribution to ground water below the LAD Area. If the application rate were not reduced, springs would likely surface downhill of the pond on the slope between the pond and Poorman Creek.

3.11.4.2.5 Effects of Diversions during Construction and Operations

Water in Little Cherry Creek above the tailings impoundment would be diverted around the tailings impoundment down to Libby Creek via a 10,800-foot Diversion Channel, which would be designed to divert large flood flows safely around the tailings impoundment. The Diversion Channel would consist of an "engineered" upper channel, and two existing natural drainage channels tributary to Libby Creek. The upper channel would convey the 6-hour Probable Maximum Flood (4,250 cfs) around the tailings impoundment. The upper channel would be about 3,200 feet long, 40 to 60 feet deep, and 19 feet wide at the bottom. Two natural channels would be used to convey water from the upper channel to Libby Creek. The northernmost channel (Channel A) is currently a 6,200-foot long intermittent drainage that flows primarily in response to snowmelt and significant rain events, with some reaches of perennial flow. The more southerly channel is about 3,000 feet long and rarely contains flowing water.

Surface water within the catchment area of the Seepage Collection Dam and within the tailings impoundment area would be captured and returned to the mill in Ramsey Creek for ore processing. Below the Seepage Collection Dam, the source of water to the former Little Cherry Creek channel would be surface water runoff from the catchment area and ground water discharge below the Seepage Collection Dam.

The flow in the unnamed tributaries of Libby Creek into which upper Little Cherry Creek would be diverted (Channels A and B) would increase and would change from intermittent to perennial flow. The tributaries are not large enough to handle the expected flow volumes and downcutting and increased sediment loading to Libby Creek would be expected as the channel stabilizes. Where possible, MMC would construct some bioengineering and structural features in the two tributary channels to reduce flow velocities, stabilize the channels, and create fish habitat. Short sections of these two channels are very steep, and it may be difficult to access such sections to complete any channel stabilization work. In addition, some sections of these two channels have very thick vegetation that may require clearing, which may create erosion and increase sediment loading to the channels.

An analysis was completed of the effect of Alternative 2 to the Little Cherry Creek watershed area and the resulting change in the flow of area streams (ERO Resources Corp. 2008a in Appendix H). Precipitation and runoff captured by the tailings impoundment and the Seepage Collection Dam would no longer flow to either the diverted or former Little Cherry Creek. During operations, 13 percent of the Little Cherry Creek watershed would continue to contribute flow to the former Little Cherry Creek channel downstream of the Seepage Collection Dam; the estimated $7Q_{10}$ flow would be 0.01 cfs and the estimated average annual flow would be 0.77 cfs. By intercepting ground water, the pumpback well system below the impoundment may further reduce base flow. The flow in Channel A would be about 60 percent of the flow of the original Little Cherry Creek. The estimated $7Q_{10}$ flow of the water diverted to Channels A and B would be 0.16 cfs. The analysis also evaluated the potential changes in the watershed areas contributing to the flow of Bear Creek and Libby Creek. For Bear Creek and Libby Creek, the change in the watershed areas that would contribute water to Bear Creek and Libby Creek near the tailings impoundment would be 3 percent or less.

3.11.4.2.6 Effects of Pumping from Make-up Wells

In Alternative 2, make-up water requirements would be about 135 gpm at a steady-state mine inflow rate of 800 gpm. If the agencies' modeled inflows of 450 gpm were more representative of

actual mine inflows, 485 gpm of make-up water would be needed. If total mine/adit inflow were not adequate to supply water for process purposes, MMC may be able to use water from pumpback wells located below the tailings impoundment for make-up purposes. Ground water wells for make-up water may also be needed. MMC has not identified specific well locations; the most likely location would be along a major drainage, such as Libby Creek upstream of LB-2000. MMC would notify the lead agencies if long-term make-up water were necessary. MMC would modify the aquatic life monitoring plan to take into account such withdrawals. Withdrawals would not proceed until the lead agencies' approval of an updated aquatic life monitoring plan. MMC would need to conduct appropriate pumping tests, and acquire the appropriate water rights from the DNRC during final design. Assuming that all of the pumped water would be coming from Libby Creek (which would be the case during steady-state pumping from Libby Creek alluvium), the effect on flow in Libby Creek may be measurable during low flow periods such as August and September. The lower value of 135 gpm (0.3 cfs) would be about 4 percent and the higher value of 485 gpm would be about 15 percent of the model-predicted base flow of the creek at LB-2000 (ERO Resources Corp. 2008b).

3.11.4.2.7 Integrated Effects to Libby Creek Streamflows during Construction and Operations

Mine facilities would alter flow in Libby Creek and its tributaries through diversions and discharges discussed in the previous sections. The integrated effects of these flow changes during November through March are shown in Table 90. The values shown in Table 90 are based on calculated average flows in area streams, and assume 450 gpm of mine and adit inflows. Predicted flow changes would be greater during lower flow periods and less in higher flow periods, and would vary slightly from the changes shown in Table 90 if mine and adit inflows differed from the agencies' inflow estimate of 450 gpm.

3.11.4.2.8 Post-Operations Effects

Effects of Mine Inflows

After the completion of mining and plugging of the adits, the mine void would fill with water. The agencies estimate that it would take about 70 years for the ground water level to return to steady state conditions (see section 3.10.4.2.1, *Mine Area*). The agencies' numerical ground water model predicts that water from the mine void would flow toward the East Fork Bull River after filling of the mine void, resulting in a flow increase in the East Fork Bull River. Prior to filling of the mine void, reductions in base flow in the East Fork Bull River would continue, but would diminish over time after the mine void was filled. The model also predicts a small flow increase in Ramsey Creek throughout its length and in the upper portion of Libby Creek within the CMW. In lower portions of Libby Creek and in all of East Fork Rock Creek, base flows are predicted to decrease slightly (ERO Resources Corp. 2008a). Base flow into Rock Lake after the mine void filled is predicted in the agencies' numerical model to be less than during pre-mining conditions, but more than during mining. St. Paul Lake may receive slightly higher recharge from ground water post-mining than pre-mining and mining conditions.

Effects of Discharges

After site reclamation, discharges of stormwater from the LAD Areas to Poorman Creek or from the Ramsey Plant Site to Ramsey Creek would no longer be subject to ELGs. Pumping of water from the mine would cease, and the adits would be plugged.

Table 90. Estimated Changes in Average Flow During November through March in Libby Creek, Alternative 2.

Variable	Estimated Change (cfs)	Source
Estimated Changes @ LB-800		
Mine inflow from Ramsey Creek	-0.05	ERO Resources Corp. 2008a
Mine inflow from Libby Creek	-0.34	ERO Resources Corp. 2008a
Potable water @ mill (11 gpm)	-0.02	Water balance (Table 8)
Estimated change @ LB-800	-0.41	
Estimated average winter flow @ LB-800	26	LB-800 watershed is 23.9 mi^2; 23.9*1.09 cfs/mi^2 = 26.1 cfs
Percent change in flow	**-2%**	
Estimated Changes @ LB-2000		
Estimated change @ LB-800	-0.41	
Tailings Evaporation/Diversion[†]	-1.23	See note; Appendix H
Make-up water	-1.08	Water balance (Table 8)
Estimated change @ LB-2000	-2.72	
Estimated average winter flow @ LB-2000	44	LB-2000 watershed is 40.7 mi^2; 40.7*1.09 cfs/mi^2 = 44.4 cfs
Percent change in flow	**-6%**	

[†]Flow reduction calculated from watershed analysis (Appendix H) and estimated average winter flow. During operations, water from 720 acres would be diverted to mill. Calculated average winter flow at Granite and Flower creeks is 1.09 cfs/mi^2. Therefore, estimated flow reduction is 1.09 cfs/mi^2 * 720 acres * 1 mi^2/640 acres = 1.23 cfs.

MMC estimates 930 gpm of tailings water would be collected by the underdrain system beneath the impoundment at closure, 200 gpm after 10 years and 50 to 100 gpm for a longer period (Klohn Crippen 2005). Runoff from the Main and Saddle dams would be diverted to the Seepage Collection Pond and would be managed until the dams were reclaimed. Post-operations, this water would be discharged at the LAD Areas, recycled to the impoundment, or treated at the Libby Adit Water Treatment Plant. Based on the agencies' analysis, the LAD Areas in Alternative 2 would be able to accept up to about 130 gpm of water for treatment during the 6-month growing season. The estimated maximum discharge rates to receiving waters are provided in Table 89. The application rate would depend on site conditions and would be adjusted to meet surface and ground water quality standards, BHES Order limits, and MPDES permit limits (see section 3.12.1.2, *Applicable Regulations and Standards*).

Seepage from the tailings impoundment into the underlying ground water is estimated to decrease from 25 gpm to 17 gpm in the first 10 years after closure, stabilizing at 5 gpm over the long term (Klohn Crippen 2006). Tailings seepage not intercepted by the underdrain system would mix with ground water and be collected by pumpback recovery wells for return to the tailings impoundment until applicable standards were met.

MMC would maintain and operate necessary wastewater management facilities until water quality standards and MPDES permit limits were met, without treatment, in all receiving waters from any discharge. Long-term treatment may be required. A MPDES permit would contain effluent limits and required monitoring for both receiving water and effluent quality. As long as

post-closure water treatment operates, the agencies would require a bond for the operation and maintenance of the water treatment plant. The level of human activity associated with facility operation, maintenance and monitoring is unknown, but has the potential of being a daily requirement and year-round in duration. The length of time that the second phase of closure activities would occur is not known, but may be decades or more.

Effects of Diversions

After the impoundment was reclaimed and runoff was no longer subject to ELGs, runoff from the reclaimed tailings impoundment surface and the watershed west of the impoundment would be routed toward Bear Creek. After the Main Dam was reclaimed and runoff was no longer subject to ELGs, a small portion of the north Main Dam abutment would be in the Bear Creek watershed and some runoff would flow to Bear Creek. The Bear Creek watershed area where runoff would meet the creek would increase by 560 acres, potentially increasing the flow in Bear Creek by 5 percent or less (ERO Resources Corp. 2008a). The larger watershed would increase runoff during stormwater runoff and would not affect base flows.

The Little Cherry Creek Diversion Channel would remain in place, routing surface water runoff in the upper Little Cherry Creek watershed in the Diversion Channel to Libby Creek. After the Main Dam and South Saddle Dam were reclaimed and runoff was no longer subject to ELGs, runoff from the South Saddle Dam and the south Main Dam abutment would flow to the Diversion Channel. Runoff from the Main Dam face would flow to the former Little Cherry Creek drainage. Post-mining, 26 percent of the Little Cherry Creek watershed area would continue to contribute flow to former Little Cherry Creek downstream of the Seepage Collection Dam (ERO Resources Corp. 2008a); the estimated $7Q_{10}$ flow of the creek would be about 0.02 cfs and the estimated average annual flow of the creek would be about 1.5 cfs. Average flows in the diverted Little Cherry Creek (Channel A) would be about 55 percent of the flow in the original Little Cherry Creek. For a short segment of Libby Creek between Channel A and Bear Creek, the change in the watershed areas that would contribute water to Libby Creek would be 3 percent or less. Below Bear Creek, flows in Libby Creek would return to pre-mining conditions, less any reduced base flows (predicted by the agencies to be immeasurable).

3.11.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

In Alternative 3, four mine facilities would be located in alternative locations. MMC would develop an impoundment site north of Poorman Creek for tailings disposal, use a plant site between Libby and Ramsey creeks, construct two additional adits in upper Libby Creek, and modify the proposed operating permit area and disturbance area at LAD Areas 1 and 2 (Figure 32).

The Libby Plant Site would be built of fill material from a large cut on the west side of the plant site. Based on preliminary analysis, the cut and fill materials would be balanced, and waste rock would not be used in plant site construction. Avoiding the use of waste rock in plant site construction would address the issue of stormwater runoff from the plant site possibly adversely affecting the water quality of nearby water resources. For MPDES permitting purposes, stormwater runoff from a plant site constructed of waste rock would be subject to ELGs and would be considered mine drainage. If the plant site were not built with waste rock, runoff would be considered stormwater and ELGs would not apply for MPDES permitting.

In Alternative 3, the proposed water management plan would be modified to address the uncertainties about quality of the mine and adit inflows and the effectiveness of LAD for primary treatment. If necessary, MMC would use either the Libby Adit Treatment Plant for primary treatment of all excess mine and adit water or a pretreatment system just for primary treatment of nitrate prior to any discharge to the LAD Areas. The LAD Areas would be used for secondary or polishing treatment and disposal. Any direct discharges to Libby Creek would require additional treatment based on effluent water quality and MPDES requirements.

3.11.4.3.1 Effects of Inflows During Construction and Mining

Changes in Creek Base Flow Due to Mining

Changes to creek base flows as a result of mining would be similar to those described in Alternative 2 (section 3.11.4.2.1, *Effects of Inflows During Construction and Mining*). In Alternative 3, two adits in addition to the Libby Adit would be in the Libby Creek drainage near the existing Libby Adit. The Ramsey Adits would not be constructed. Changes in base flow in Ramsey Creek would be nearly zero and not measurable in Alternative 3. Three adits in the Libby Creek drainage may increase the reductions in base flow in Libby Creek predicted for Alternative 2, but the changes would be relatively small, and would depend on the additive effect of two additional adits parallel to the existing Libby Adit. The ground water drawdown resulting from inflow to each of the three adits would overlap. As a result, the total water production of the three adjacent adits would be much less than the Libby Adit in the Libby Creek drainage and the two Ramsey Adits in the Ramsey Creek drainage.

Impacts to Lakes

Effects to lakes in the CMW would be the same as those described in Alternative 2 (section 3.10.4.2.1, *Mine Area*). Ramsey Lake would not be affected because the production adits would be in the Libby Creek drainage. Lake monitoring would be implemented at Rock Lake, St. Paul Lake, and the Libby Lakes as soon as possible prior to mining to assist in developing the baseline water balance of the lakes. Major water budget variables would be accounted for and/or estimated, including evaporation, seepage, precipitation and surface water inflows and outflows, as well as continuously recorded lake levels. The lake monitoring system design and evaluation would be coordinated with the agencies. The same monitoring (Appendix C) would occur during mining to determine whether the lake levels were affected during mining operations.

3.11.4.3.2 Effects of Timber Clearing on Streamflows

Based on the ECAC model results (Appendix H), timber clearing is not predicted to measurably increase the peak flow of any mine area streams.

3.11.4.3.3 Effects of New Road Crossings on Streamflows and Floodplains

Alternative 3 would require one new road crossing over a major stream and one new road crossing over a minor stream (Table 88). It is estimated that new roads would cross 2.3 acres of floodplain. During construction, disturbances within the floodplain would be minimized. After construction is completed, the bridges and culvert would not affect natural streamflows. Table 88 provides information on stream crossings and floodplains that may be affected by the combination of Alternative 3 for the mine and Alternatives C, D or E for the transmission line.

3.11.4.3.4 Effects of Discharges during Construction and Mining

In Alternative 3, the sources and routes of water to receiving streams would be the same as Alternative 2 (Table 91); the agencies' expected application rate at the LAD Areas, discharge

rates to ground water beneath the LAD Areas would be slightly higher. In this alternative, the size of the LAD Areas would be 307 acres, while the maximum application rate is estimated to be 198 gpm (see sections 3.12.2.3, *Impact Analysis* and 3.10.4.3.3, *LAD Areas* for further discussion). Additional mine water would be sent to the Libby Adit Water Treatment Plant and would be discharged under the existing Libby Adit MPDES permit. The maximum discharge rates to receiving waters provided in Table 91 would be the same during construction, operations, and post-mining. As in Alternative 2, discharge rates would vary based on the site-specific hydrogeologic conditions under and downgradient of the LAD Areas and effluent limits set for discharges at the LAD Areas.

Table 91. Wastewater Sources to Receiving Streams and/or Ground Water and Estimated Maximum Discharge Rates during Construction, Mining, and Post-Mining, Alternative 3.

Water Route and Source	Receiving Stream/ Monitoring Site	Estimated Maximum Discharge Rate (gpm)
Estimated Discharge from LAD Areas to Streams		
Percolation to ground water from LAD Area 1	Ramsey Creek/RA-400	18.5
	Poorman Creek/PM-1000	3.4
Percolation to ground water from LAD Area 2	Ramsey Creek/RA-600	11
	Poorman Creek/PM-1200	10.7
	Libby Creek/LB-800	3.7
Stormwater Runoff Subject to ELGs in Streams		
Surface runoff of mine drainage from LAD Areas when exceeds 10-year/24-hour storm event (retention pond capacity)	Poorman Creek/PM-1200	Storm dependent

The monitoring site listed for each wastewater source is one of many that would be included in a comprehensive monitoring program (see Appendix C for the agencies' proposed surface water, ground water, and aquatic life monitoring).

The discharges to mine area streams from the LAD Areas would be small, would occur as increased ground water seepage to the stream channels, and would likely not be measurable. The largest percent flow increase would be to Ramsey Creek, where the discharge of 18.5 gpm (0.04 cfs) from the LAD Areas would be about 3 percent of the $7Q_{10}$ flow (1.4 cfs, see section 3.12.2.3, *Impact Analysis*) of Ramsey Creek. In Alternative 3, stormwater runoff from the LAD Areas would be captured in a lined stormwater retention pond, and discharged to Poorman Creek via a constructed channel designed to minimize erosion.

3.11.4.3.5 Effects of Diversions during Construction and Mining

The Poorman Tailings Impoundment would be located in two intermittent drainages. This alternative would not require the diversion of Little Cherry Creek or Poorman Creek. Any flow within the watershed above the impoundment would be routed to Poorman or Little Cherry creeks. Water from a 146-acre watershed above the Poorman Tailings Impoundment would be diverted to Poorman Creek, increasing the watershed of Poorman Creek by about 4 percent (ERO Resources Corp. 2008a). Water from an 80-acre watershed above the Poorman Tailings Impoundment would be diverted to Little Cherry Creek, an increase of about 8 percent in the Little Cherry Creek watershed. Because the flows in the drainages are intermittent and watershed

areas are small, flow rates are expected to be small. As in Alternative 2, precipitation intercepted by the impoundment and runoff from the dam would be intercepted and used in the mill. The watersheds of the drainages in the Poorman Impoundment Site (Channels A and B) would be reduced by about 85 percent during operations. Flows in Channels A and B, which are currently intermittent, would rarely occur during operations. The change in watershed areas that would contribute water to the Libby Creek watersheds would be 3 percent or less.

3.11.4.3.6 Effects of Pumping from Make-up Wells

In Alternative 3, make-up water requirements would be about 50 gpm at a steady-state mine inflow rate of 450 gpm. Make-up wells would not be needed at steady-state inflows greater than about 500 gpm or if the needed water were supplied by the pumpback wells. If needed to provide any necessary make-up water requirements, a water supply well field located north of the Seepage Collection Pond would draw from Libby Creek alluvial ground water (Figure 26). As in Alternative 2, MMC would notify the lead agencies if long-term make-up water were necessary. In Alternatives 3 and 4, MMC would likely withdraw ground water for operational use during the high flow months of April through July, but may withdraw water during other months except when flows are low. MMC would modify the aquatic life monitoring plan to take into account such withdrawals. Withdrawals would not proceed until the lead agencies' approval of an updated aquatic life monitoring plan. MMC would need to conduct appropriate pumping tests, and acquire the appropriate water rights from the DNRC during final design. The effect on flow in Libby Creek would likely not be measurable. During steady-state pumping, when all of the 50 gpm pumped from the make-up wells would come directly from surface flows in Libby Creek, 50 gpm (0.11 cfs) would be less than 1 percent of the model-predicted base flow of the creek at LB-2000 (ERO Resources Corp. 2008b).

3.11.4.3.7 Integrated Effects to Libby Creek Streamflows during Construction and Operations

Mine facilities would alter flow in Libby Creek and its tributaries through diversions and discharges discussed in the previous sections. The integrated effects of these flow changes are provided in Table 92. Assumptions described previously for Alternative 2 (Table 90) apply to Alternative 3.

3.11.4.3.8 Post-Operations Effects

Effects of Mine Inflows

The effect of mine inflows post-operations would be similar to Alternative 2 (section 3.11.4.2.8, *Post-Operations Effects*). The base flow of Ramsey Creek after mining probably would not change. In addition, if hydrologic modeling during initial mine operations (by Year 5 of operations) determined that one or more bulkheads were necessary to minimize changes in East Fork Rock Creek and East Fork Bull River streamflows, as well as lake levels in Rock Lake, MMC would submit a plan for bulkheads to the agencies for approval. One or more bulkheads would be maintained underground, if necessary, after the plan's approval.

Effects of Discharges

After site reclamation, discharges of stormwater from the LAD Areas to Poorman Creek would no longer be subject to ELGs. Post-closure management of tailings water would be the same as Alternative 2 (section 3.11.4.2.8, *Post-Operations Effects*). The subsurface materials at the Poorman Impoundment Site are similar to those at the Little Cherry Creek Impoundment Site, and seepage rates would be expected to be similar.

Table 92. Estimated Changes in Average Flow During November through March in Libby Creek, Alternative 3.

Variable	Estimated Change (cfs)	Source
Estimated Changes @ LB-800		
Mine inflow from Libby Creek	-0.39	ERO Resources Corp. 2008a
Potable water @ mill (11 gpm)	-0.02	Water balance (Table 8)
Estimated change @ LB-800	-0.41	
Estimated average winter flow @ LB-800	26	LB-800 watershed is 23.9 mi^2; 23.9*1.09 cfs/mi^2 = 26.1 cfs
Percent change in flow	**-2%**	
Estimated Changes @ LB-2000		
Estimated change @ LB-800	-0.41	
Tailings Evaporation/Diversion†	-1.04	See note; Appendix H
Make-up water	-0.11	Water balance (Table 8)
Estimated change @ LB-2000	-1.56	
Estimated average winter flow @ LB-2000	44	LB-2000 watershed is 40.7 mi^2; 40.7*1.09 cfs/mi^2 = 44.4 cfs
Percent change in flow	**-4%**	

†Flow reduction calculated from watershed analysis (Appendix H) and estimated average winter flow. During operations, water from 611 acres would be diverted to mill, which is 85% of the area diverted by Alternative 2. Calculated average winter flow at Granite and Flower creeks is 1.09 cfs/$mile^2$. Therefore, estimated flow reduction is 1.09 cfs/mi^2 * 611 acres * 1 mi^2/640 acres = 1.04 cfs.

Effects of Diversions

After the impoundment was reclaimed and runoff was no longer subject to ELGs, runoff from the reclaimed Poorman Tailings Impoundment surface would be routed toward Little Cherry Creek. The watershed area of Little Cherry Creek would increase by 644 acres, an increase of 38 percent (ERO Resources Corp. 2008a). Average annual flows in Little Cherry Creek would increase by similar percentages. The larger watershed would increase runoff during stormwater runoff and would not affect base flows. After the Main Dam was reclaimed and runoff no longer subject to ELGs, runoff would flow to Poorman Creek, or Libby Creek via Channels A or B. Changes in the watershed areas contributing water to Poorman and Libby Creek would be 3 percent or less. Below Little Cherry Creek, flows in Libby Creek would return to pre-mining conditions, less any reduced base flows (predicted by the agencies to be immeasurable).

3.11.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would be similar to Alternative 3, but would have modifications to MMC's proposed Little Cherry Creek Tailings Impoundment Site as part of the alternative. All other modifications and mitigations described in Alternative 3, other than those associated with the Poorman Tailings Impoundment Site, would be part of Alternative 4. The amount of seepage collected by the seepage collection system, which includes seepage from the tailings impoundment, may be increased by better locating the Seepage Collection Dam with respect to the local geologic conditions. Any tailings seepage not intercepted by the drains beneath the

impoundment and dams would likely discharge to the former Little Cherry Creek watershed through the fractured bedrock aquifer. Consequently, siting the Seepage Collection Dam at or below the location where bedrock outcrops in the Little Cherry Creek drainage would increase the likelihood that the seepage would be collected by the dam. In Alternative 4, MMC would conduct additional geotechnical work near the Seepage Collection Dam during final design and site the dam lower in the drainage if technically feasible. Pumpback wells would intercept tailings impoundment seepage not intercepted by the underdrain system before it reached surface water.

3.11.4.4.1 Effects of Inflows During Construction and Mining

Changes in Creek Base Flow Due to Mining

Changes to creek base flows as a result of mining would be the same as those described in Alternative 3 (section 3.11.4.3.1, *Effects of Inflows During Construction and Mining*).

Impacts to Lakes

Effects on lakes and monitoring would be the same as Alternatives 3 (section 3.11.4.3.1, *Effects of Inflows During Construction and Mining*).

3.11.4.4.2 Effects of Timber Clearing on Streamflows

Based on the ECAC model results (Appendix H), timber clearing is not predicted to measurably increase the peak flow of any mine area streams.

3.11.4.4.3 Effects of New Road Crossings on Streamflows and Floodplains

Alternative 4 would require two new road crossings over major streams and one road crossing over a minor stream (Table 88). No floodplains would be crossed by new roads. During construction, disturbances within the floodplain would be minimized. After construction is completed, the bridges and culvert would not affect natural streamflows. Table 88 provides information on stream crossings and floodplains that may be affected by the combination of Alternative 4 for the mine and Alternatives C, D, or E for the transmission line.

3.11.4.4.4 Effects of Discharges during Construction and Mining

The effects to Ramsey, Poorman, and Libby creeks due to stormwater discharges and discharges from the LAD Areas would be same as Alternative 3 (section 3.11.4.3.4, *Effects of Discharges during Construction and Mining*).

3.11.4.4.5 Effects of Diversions during Construction and Mining

The effect of diversions on the streamflows in former Little Cherry Creek, Channel A, and Bear Creek would be the same as described for Alternative 2 (section 3.11.4.2.5, *Effects of Diversions during Construction and Operations*).

3.11.4.4.6 Effects of Pumping from Make-up Wells

Effects due to pumping from the make-up wells would be the same as Alternative 3 (section 3.11.4.3.6, *Effects of Pumping from Make-up* Wells). The effect on flow in Libby Creek would not be measurable during the high flow months and would be about 2 percent of the estimated average winter flow of the creek at LB-2000 (Table 93).

3.11.4.4.7 Integrated Effects to Libby Creek Streamflows during Construction and Operations

Mine facilities would alter flow in Libby Creek and its tributaries through diversions and discharges discussed in the previous sections. The integrated effects of these flow changes are provided in Table 93. Assumptions described previously for Alternative 2 (Table 90) apply to Alternative 4.

Table 93. Estimated Changes in Average Flow During November through March in Libby Creek, Alternative 4.

Variable	Estimated Change (cfs)	Source
Estimated Changes @ LB-800		
Mine inflow from Libby Creek	-0.39	ERO Resources Corp. 2008a
Potable water @ mill (11 gpm)	-0.02	Water balance (Table 8)
Estimated change @ LB-800	-0.41	
Estimated average winter flow @ LB-800	26	LB-800 watershed is 23.9 mi^2; 23.9*1.09 cfs/mi^2 = 26.1 cfs
Percent change in flow	**-2%**	
Estimated Changes @ LB-2000		
Estimated change @ LB-800	-0.41	
Tailings Evaporation/Diversion†	-1.23	See note; Appendix H
Make-up water	-1.08	Water balance (Table 8)
Estimated change @ LB-2000	-2.72	
Estimated average winter flow @ LB-2000	44	LB-2000 watershed is 40.7 mi^2; 40.7*1.09 cfs/mi^2 = 44.4 cfs
Percent change in flow	**-6%**	

†Flow reduction calculated from watershed analysis (Appendix H) and estimated average winter flow. During operations, water from 720 acres would be diverted to mill. Calculated average winter flow at Granite and Flower creeks is 1.09 cfs/$mile^2$. Therefore, estimated flow reduction is 1.09 cfs/mi^2 * 720 acres * 1 mi^2/640 acres = 1.23 cfs.

3.11.4.4.8 Post-Operations Effects

Effects of Inflows and Discharges

The effect of mine inflows after mining would be the same as Alternative 3 (section 3.11.4.3.8, *Post-Operations Effects*). Management of stormwater and other discharges would be the same as Alternative 3 (section 3.11.4.3.8, *Post-Operations Effects*).

Effects of Diversions

After the impoundment surface was reclaimed and runoff was no longer subject to ELGs, runoff from the reclaimed tailings impoundment surface would be routed via the permanent Diversion Channel and Channel A to Libby Creek (as compared to Alternative 2, where runoff from the reclaimed tailings impoundment surface would flow toward Bear Creek). After the dams were reclaimed and runoff was no longer subject to ELGs, runoff from the South Saddle Dam and the south Main Dam abutment would flow to the Diversion Channel. Consequently, the watershed of Channel A would increase by about 500 acres post-mining, compared to operational conditions.

This additional area may require MMC to complete more channel stabilization work in Channel A due to increased flows, plus follow-up monitoring. Average annual flow in the diverted Little Cherry Creek would be about five times the existing flow in Channel A, but about 10 percent less than the current flow of Little Cherry Creek (Appendix H).

After the dams were reclaimed and runoff from them was no longer subject to ELGs, runoff from the Main Dam would flow to the former Little Cherry Creek channel, not to Bear Creek. Post-mining, the watershed area contributing water to the former Little Cherry Creek channel would decrease by 85 percent (compared with the pre-mining watershed area) directly below the tailings impoundment and by 74 percent (compared with the pre-mining watershed area) at the confluence of former Little Cherry and Libby creeks. Changes in the watershed areas contributing flow to Bear and Libby Creek would be 5 percent or less. Below Bear Creek, flows in Libby Creek would return to pre-mining conditions, less any reduced base flows (predicted by the agencies to be immeasurable).

3.11.4.5 Alternative A – No Transmission Line

In Alternative A, the transmission line and substation for the Montanore Project would not be built. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Possible impacts to streams due to construction, operation, and maintenance of a new transmission line would not occur.

3.11.4.6 Alternative B – MMC Proposed Transmission Line (North Miller Creek Alternative)

Alternative B transmission line would have six major stream crossings: Hunter Creek, the Fisher River, an unnamed tributary to Miller Creek, Howard Creek, Libby Creek, and Ramsey Creek. The alignment also would have 16 new crossings over minor streams. Three new road crossings over major streams and one new road crossing over a minor stream would be required. The transmission line would cross 1.1 miles of floodplains and require 1.6 acres of new roads within a floodplain (Table 88). Eight structures would be located in a floodplain. Construction would be curtailed during heavy rains or high winds to prevent erosion to streams. MMC identified four possible stream crossings: fords, culverts, arches, and bridges. Culverts would be the most commonly used crossing method. Because the construction time of the line would be short, MMC anticipates that no drainage would be provided for the temporary roads, but would follow the agencies' guidance if installation of culverts were required. Culvert installations on perennial streams would meet BMP requirements. In all transmission line alternatives, the DEQ would require on-site inspections of stream crossings associated with the 230-kV transmission line to determine the most suitable crossing methods and timing of construction that would minimize impacts on floodplains and streamflow (see Environmental Specifications in Appendix D). As proposed, culverts would remain after the project was completed. During construction, streamflows may be temporarily dammed or routed around construction activities. Damming the stream would reduce or eliminate flow below the dam for a short period of time. After construction is completed, the culverts would not affect natural streamflows.

Based on the ECAC model results (Appendix H), the combination of Alternative 2 and Alternative B would increase peak flow in Ramsey Creek by 8.6 percent. Other peak streamflow increases are predicted to be small and would not be measurable.

3.11.4.7 Alternative C – Modified North Miller Creek Transmission Line Alternative

Six stream major streams would be crossed by the transmission line in this alternative: Sedlak Creek, Hunter Creek, Fisher River, an unnamed tributary to Miller Creek, Howard Creek, and Libby Creek. The transmission line would cross an estimated 0.3 mile of floodplains and require 0.5 acre of new roads within a floodplain (Table 88). One structure would be located in a floodplain. Alternative C would require no new roads crossings over major streams, and three new road crossings over minor streams. Culverts would be installed, if needed, on roads used for maintenance access. Other aspects of stream crossings, such as compliance with the Environmental Specifications in Appendix D, would be the same as Alternative B (section 3.11.4.6, *Alternative B – MMC Proposed Transmission Line (North Miller Creek Alternative)*).

In Alternatives C, D, and E, installation of culverts, bridges, or other structures at stream crossings would be specified by the agencies following on-site inspections with DEQ, FS, FWP, and local conservation districts. Installation of culverts or other structures in a water of the United States would be in accordance with the U.S. Army Corps of Engineers 404 and DEQ 318 permit conditions. All culverts would be sized according to Revised Hydraulic Guide KNF (1990) and amendments. Where new culverts were installed, they would be installed so water velocities or positioning of culverts would not impair fish passage. Stream crossing structures would be able to pass the 100-year flow event.

After line installation was completed, access roads would be changed to intermittent stored service (section 2.9.3.2, *Access Road Construction and Use*). Culverts would be removed by the KNF if determined to be high risk for blockage or failure. Stream banks would be laid back to allow streamflows to pass without scouring or ponding. Transmission line roads would be decommissioned after mine closure and removal of the transmission line. Culverts would be removed and fill areas sloped back and stabilized during road decommissioning.

Based on the KNF ECAC model results (Appendix H), timber clearing for access roads and the transmission line is not predicted to measurably increase the peak flow of any streams.

3.11.4.8 Alternative D – Miller Creek Transmission Line Alternative

Eight major streams would be crossed by the transmission line in this alternative: Sedlak Creek, Hunter Creek, Fisher River, an unnamed tributary to Miller Creek, Miller Creek, Howard Creek (at two locations), and Libby Creek. The transmission line would cross an estimated 0.3 mile of floodplains and require 0.6 acre of new roads within a floodplain (Table 88). Two structures would be located in a floodplain. Alternative D would require no new road crossings over major streams, and five new road crossings over minor streams. Road and culvert construction, maintenance and removal, and effects on peak flows would be the same as Alternative C (section 3.11.4.7, *Alternative C – Modified North Miller Creek Transmission Line Alternative*).

3.11.4.9 Alternative E – West Fisher Creek Transmission Line Alternative

Nine major streams would be crossed by the transmission line in this alternative: Sedlak Creek, Hunter Creek, Fisher River, West Fisher Creek, two unnamed tributaries to West Fisher Creek, Howard Creek (at two locations) and Libby Creek. The transmission line would cross an estimated 0.3 mile of creek floodplains and require less than 0.1 acre of new roads within a floodplain (Table 88). One structure would be located in a floodplain. The alternative would require no new road crossings over major streams, and four new crossings over minor streams.

Road and culvert construction, maintenance and removal, and effects on peak flows would be the same as Alternative C (section 3.11.4.7, *Alternative C – Modified North Miller Creek Transmission Line Alternative*).

3.11.4.10 Cumulative Effects

Cumulative effects in the analysis area include past and current actions that are likely to continue in the future and reasonably foreseeable actions that could affect streamflows, spring flows, and lake levels. This includes other area mining activities, particularly instream suction dredging and placer exploration, which in the past have created physical substrate habitat alterations in area streams. Suction dredging tends to destabilize stream channels and may alter streamflows, particularly during high flows. Mine reclamation activities are also ongoing and planned. Other activities that could affect surface water flows include timber harvesting, land clearing, home construction, road construction, septic field installation, water well drilling, livestock grazing, and stream channel and bank stabilization or restoration projects. These activities could either increase or reduce water sources to streams, springs and lakes; other than the Montanore and Rock Creek Projects, cumulative effects would be minor.

3.11.4.10.1 Effects of Mine Inflows to Montanore and Rock Creek Projects

The Montanore and Rock Creek Projects would cumulatively affect base flows in the East Fork Rock Creek and East Fork Bull River. No other aspects of the two projects would have cumulative effects on surface water resources.

The agencies' numerical model predicted that the cumulative change in base flows in East Fork Rock Creek from the headwaters to about 1.25 miles downstream of Rock Lake would be identical to change that would occur with operation of only the Montanore Project. Below this location, model-predicted base flow reductions would be greater with operation of the Rock Creek Project. Changes in base flow in East Fork Rock Creek due to mine operations may be measurable. Below Rock Creek Meadows, it may be difficult to separate possible impacts due to mine dewatering from the natural variability of base flow. Changes in base flow at and below Rock Creek Meadows may be masked by ground water stored in thick alluvium along the middle and lower reaches of East Fork Rock Creek.

The agencies' numerical model predicted base flow reductions would be greater cumulatively throughout the length of the East Fork Bull River (up to 300 gpm less) during mining and post-mining (up to 60 gpm less). It may be possible to measure base flow changes due to mining that may occur during mining operations of one or both mines.

3.11.4.11 Regulatory/Forest Plan Consistency

The proposed activities in Alternatives 2, 3, and 4 are consistent with the KFP for water resources. Because construction, operation, and closure of the mine and transmission line under all alternatives would be in compliance with all applicable water quality standards and permit requirements, the chosen mine and transmission line alternatives would be in compliance with the Montana Water Quality Act.

3.11.4.12 Irreversible and Irretrievable Commitments

During operations, use of mine and adit inflows and any water needed for make-up or potable water would be an irretrievable commitment of resources. Any change in stream or spring flow or lake levels during or after mining would be an irreversible commitment of resources.

The tailings impoundment in the Little Cherry Creek watershed in Alternatives 2 and 4 would permanently alter the flow in Little Cherry Creek, Bear Creek (Alternative 2 only), Libby Creek, and unnamed tributaries to Libby Creek. Alternative 3 would alter the flow in the Little Cherry Creek, Poorman Creek, Libby Creek, and unnamed tributaries to Libby Creek. These flow changes would be an irreversible commitment of surface water resources.

3.11.4.13 Short-Term Uses and Long-Term Productivity

The short-term use of surface water resources would be the use of project streams for discharge of treated mine and adit water in the various alternatives. Changes that may occur that would affect the long-term productivity of surface water resources include:

- Changes in stream and spring flows, as well as changes in the levels of Rock and St. Paul lakes that may occur due to mine inflows
- Changes to watersheds (and the streams and springs within them) that would be permanently covered by the alternative tailings impoundment sites
- Changes in streamflows that would occur due to permanent stream diversions around or from the alternative tailings impoundment sites

3.11.4.14 Unavoidable Adverse Environmental Effects

Based on the agencies' conceptual model of the connection of surface and ground water in the analysis area, mining of the ore body may unavoidably reduce streamflows and spring flows, and deep ground water inflow to Rock Lake. A change in deep ground inflow to Rock Lake may affect the level of Rock Lake.

3.12 Surface Water Quality

3.12.1 Regulatory Framework

The Montana DEQ is responsible for enforcing compliance with water quality laws on all lands in Montana, excluding Tribal lands. The Forest Service has a Memorandum of Understanding with the State that allows the Forest Service and DEQ to work collaboratively to address water quality issues on National Forest System lands. The 1987 KFP established management areas within the forest with different goals and objectives based on the capabilities of lands within this area (USDA Forest Service 1987).

3.12.1.1 Permits and Authorizations Held by MMC

3.12.1.1.1 Board of Health and Environmental Sciences Order No. 93-001-WQB

Section 1.3.2.2, *Water Quality-Related Approvals* discusses previous water quality related approvals associated with the Montanore Project. Pursuant to the 1971 nondegradation statute and regulations then in effect, Noranda submitted a "Petition for Change in Quality of Ambient Waters" in 1989 to the BHES requesting an increase in the concentration of select constituents in surface and ground water above ambient concentrations. Noranda submitted supplemental information to support the petition in 1992. Under the 1971 statute, any change in surface or ground water quality above ambient concentrations was prohibited, no matter how small the effect, unless the BHES determined that the changes did not preclude present or anticipated uses of water resources, and were justified as a result of necessary social or economic development.

Noranda submitted a "Petition for Change in Quality of Ambient Waters" in 1989 to the BHES requesting an increase in the concentration of select constituents in surface and ground water above ambient water quality, as required by Montana's 1971 nondegradation statute. Supplemental information to support the petition was submitted by Noranda in 1992. In response to Noranda's petition, the BHES issued an Order in 1992 (BHES 1992). The Order is presented in Appendix A. The Order established numeric nondegradation limits for total dissolved solids, chromium, copper, iron, manganese and zinc in both surface and ground water, as well as nitrate (ground water only) and total inorganic nitrogen (surface water only) (Table 94). These nondegradation limits apply to all surface and ground water affected by the Montanore Project and remain in effect during the operational life of the mine and for so long thereafter as necessary (BHES 1992).

The Order also indicates that land treatment, as then proposed and currently proposed in Alternative 2, would satisfy the state requirement to treat industrial wastes using technology that is the best practicable control technology available. In 1992, the DHES (now DEQ) determined that land treatment would provide adequate secondary treatment of nitrate (80 percent removal) and metals. The Order requires the DEQ to review design criteria and final engineering plans to determine that at least 80 percent removal of nitrogen would be achieved and the total inorganic nitrogen concentration in Libby, Ramsey, or Poorman creeks would not exceed 1 mg/L. The Order also adopted the modifications developed in Alternative 3, Option C, of the Final EIS (1992), addressing surface and ground water monitoring, fish tissue analysis, and instream biological monitoring.

Table 94. Nondegradation Limits Established by BHES Order for the Montanore Project and Montana Surface Water Quality Standards.

Parameter – Category[1]	BHES Order Nondegradation Limits (mg/L)	Human Health Standard (mg/L)	Aquatic Life Standard[2]	
			Acute (mg/L)	Chronic (mg/L)
Temperature (°F) - H	—	—	1°F max increase for naturally occurring range of 32° to 66°F, 67°F max 0.5°F max increase for naturally occurring 66.5°F or greater 2°F per hour max decrease for naturally occurring temperatures above 55°F; 2°F max decrease for naturally occurring range of 32° to 55°F	
pH (s.u.)	—	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5
Dissolved Oxygen - T	—	—	8.0 (early life) 4.0 (other life stages)	9.5 (early life) 6.5 (other life stages)
Total dissolved solids	100	—	—	—
Turbidity (NTU) - H	—	—	No increase above ambient	No increase above ambient
Total Inorganic Nitrogen (TIN), as N – T	1	—	—	—
Nitrate + nitrite, as N – T	See TIN value	10	No excessive amounts	No excessive amounts
Ammonia, as N - T	See TIN value	—	Calculated based on stream pH	Calculated based on stream pH and temperature
Aluminum[3] – T	—	—	0.75	0.087
Antimony[3] – T	—	0.0056	—	—
Arsenic[3] – C	—	0.01	0.34	0.15
Cadmium[3] – T	—	0.005	0.00052	0.000097
Chromium[3] – T	0.005	—	0.579	0.0277
Copper[3] – T	0.003	1.3	0.00379	0.00285
Iron[3] – H	0.1	—[5]	—	1.0
Lead[3] – T	—	0.015	0.014	0.00055
Manganese[3] – H	0.05	—[5]	—	—
Mercury[3] – T	—	0.00005	0.0017	0.00091
Nickel[3] – T	—	0.1	0.145	0.0161
Selenium[3] – T	—	0.05	0.02	0.005
Silver[3] – T	—	0.1	0.00037	—
Zinc[3] – T	0.025	2	0.037	0.037

[1] T = toxic; C = carcinogen; H = harmful (aquatic life).
[2] Many metals standards are hardness dependent; for this table, values presented are based on a hardness of 25 mg/L.
[3] All metals standards, except aluminum, are based on total recoverable concentrations. Aluminum standards are based on the presence of dissolved aluminum and are valid only in pH range of 6.5 to 9.
[4] Standards are water column concentrations. Early stages include all embryonic, larval stages and all juvenile fish to 30 days following hatching. Acute concentration is instantaneous concentration to be achieved at all times; chronic concentration is 30-day mean.
[5]The concentration of iron or manganese must not reach concentrations that interfere with the uses specified in the surface and ground water standards (ARM 17.30.601 *et seq.* and 17.30.1001 *et seq.*). The Secondary Maximum Contaminant Level of 0.3 mg/L for iron and 0.05 mg/L, which are based on aesthetic properties such as taste, odor, and staining, may be considered as guidance to determine the levels that will interfere with the specified uses.
mg/L = milligrams/liter; — = No applicable standard.
Source: BHES 1992; Circular DEQ-7, Montana Numeric Water Quality Standards, DEQ 2008; ARM 17.30.623.

3.12.1.1.2 MPDES Permit No. MT-0030279

A MPDES permit was originally issued to Noranda in November 1997 for Libby Adit discharge to the local ground water or Libby Creek. The permit was renewed by DEQ, effective April 1, 2006 and will expire on March 31, 2011. Three outfalls are included in the permit (Figure 15): Outfall 001 – percolation pond; Outfall 002 – infiltration system of buried pipes; and Outfall 003 – pipeline outlet to Libby Creek. A minor modification of the MPDES permit in 2008 reflected an owner/operator name change from Noranda to MMC.

3.12.1.2 Applicable Regulations and Standards

MPDES permits are required for discharges of wastewater to state surface waters. MPDES permits regulate discharges of wastewater by imposing, when applicable, technology-based effluent limits (TBELs) and state surface water quality standards, which include numeric and narrative requirements, nondegradation criteria, and Total Maximum Daily Loads (TMDLs).

3.12.1.2.1 Technology-Based Effluent Limits and Effluent Limitations Guidelines

For industrial sources, national ELGs have been developed for specific categories of industrial facilities and represent technology-based effluent limits. The Montanore Mine site is in an industrial category that is specifically identified and included in the ELGs at 40 CFR 440, Ore Mining and Dressing Point Source Category, Subpart J – Copper, Lead, Zinc, Gold, Silver, and Molybdenum Ores Subcategory.

The federal ELGs apply to mine drainage and process wastewater that discharge to surface water. Mine drainage is “any water pumped, drained, or siphoned from a mine” (40 CFR 440.131). Process wastewater is “any water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate produce, finished product, by-product, or waste product” (40 CFR 401.11). In terms of the ELG requirements for copper mines that use froth flotation for milling, tailings water is process wastewater. Tailings impoundment seepage would be addressed in the MPDES permit in the context of the federal ELGs. Process wastewater from copper mines that use froth flotation for milling is not allowed to be discharged to state surface waters except in areas of net precipitation.

3.12.1.2.2 State Standards

All surface water in the analysis area is classified by DEQ as either A-1 (within wilderness areas) or B-1. Water quality standards are nearly identical for A-1 and B-1 waterbodies. An A-1 classification has stricter protection requirements associated with allowable levels of impurities for drinking, culinary, and food-processing purposes, and stricter protection requirements associated with allowable levels of turbidity. The water quality of both A-1 and B-1 waterbodies must be suitable for bathing, swimming, and recreation, aquatic life, wildlife, and agricultural and industrial uses. Surface water in the wilderness is classified as A-1, where stricter allowable changes are defined to maintain the water quality classification.

Montana water quality standards for inorganic pollutants applicable to the project are provided in Table 94. The DEQ also has required reporting limits for pollutants. Some surface water quality parameters (*i.e.*, specific conductivity, hardness, total dissolved and suspended solids, carbonate, bicarbonate, chloride, and sulfate) have no numeric standards in Montana, but these parameters serve as indicators of water purity and potential human health or aquatic life impairment. Numeric nondegradation limits in surface and ground water adjacent to the Montanore Project were established by the BHES Order for certain parameters; state surface water quality standards

for these parameters are also provided in Table 94. For B-1 streams, short-term narrative standards for total suspended sediment and turbidity may be established for stream-related construction activities.

3.12.1.2.3 Nondegradation

The Montana Water Quality Act requires the DEQ to protect high quality waters from degradation. The current nondegradation rules were adopted in 1994 in response to amendments to Montana's nondegradation statute in 1993 and apply to any activity resulting from a new or increased source that may degrade a high quality water. These rules do not apply to sources, such as the Montanore Project, that received an authorization to degrade prior to the adoption of the 1993 amendments to Montana's nondegradation statute.

3.12.1.2.4 Total Maximum Daily Loads

Section 303(d) of the federal Clean Water Act requires states to assess the condition of state waters to determine where water quality is impaired (does not fully support uses identified in the stream classification or does not meet all water quality standards) or threatened (is likely to become impaired in the near future). The result of this review is the compilation of a 303(d) list, which states must submit to the EPA biannually. Section 303(d) also requires states to prioritize and target water bodies on their list for development of water quality improvement strategies (*i.e.*, Total Maximum Daily Loads or TMDLs), and to develop such strategies for impaired and threatened waters. A TMDL has not been prepared or approved by the EPA for any pollutant in the analysis area. Three streams in the analysis area are listed on the most current Montana 303(d) list. These streams are two segments of Libby Creek, the Fisher River, and Rock Creek.

Libby Creek is separated into two segments on the 303(d) list. The upper segment is from 1 mile above Howard Creek to the U.S. 2 bridge. This segment is listed as not supporting drinking water and partially supporting its fishery and aquatic life. Agricultural and industrial beneficial uses are fully supported. Contact recreation has not been assessed. Probable causes of impairment listed are alteration in stream-side or littoral vegetative covers, mercury, and physical substrate habitat alterations. Probable sources of impairment are from impacts from abandoned mine lands and placer mining.

The segment of Libby Creek from the U.S. 2 crossing to the confluence with the Kootenai River is listed as impaired for its fishery and aquatic life. Probable causes of impairment are physical substrate habitat alterations and siltation/sedimentation. Probable sources of impairment are listed as site clearance (land development or redevelopment), streambank modification/destabilization, and unknown sources. Agricultural and industrial uses are fully supporting and drinking water and contact recreation have not been assessed.

The Fisher River from the confluence of the Silver Butte Fisher River and the Pleasant Valley Fisher River to the confluence with the Kootenai River is also included on the Montana's 303(d) list, with aquatic life support and cold-water fishery uses only partially supported. Probable causes for the Fisher River impairment are a high flow regime and high lead concentrations (source unknown), with probable sources of these impairments listed as channelization, grazing, road runoff, road construction, silvicultural activities, and streambank modification and destabilization.

Rock Creek from the headwaters to the mouth below Noxon Dam is also listed, with aquatic life support and cold-water fishery uses only partially supported. Probable causes for the Rock Creek

impairment are other anthropogenic substrate alterations, with probable sources of these impairments listed as silvicultural activities. TMDLs are not required on Rock Creek because no pollutant-related use impairment has been identified.

3.12.2 Analysis Area and Methods

3.12.2.1 Analysis Area

The geographic scope of the analysis area includes the area where surface water quality may be affected either by mine operations or by installation and maintenance of the transmission line. This area includes the Libby Creek, Rock Creek, East Fork Bull River, Miller Creek, Fisher River, and Midas Creek watersheds (Figure 76).

3.12.2.2 Baseline Data Collection

Noranda began a project-specific surface water quality sampling program during late April 1988, and continued through March 1989 for the initial baseline monitoring period. Water quality samples were collected simultaneously with flow measurements at each station (Table 95). For the first year of baseline monitoring, samples were collected twice monthly during the spring runoff period (April through June) and monthly during non-runoff flow conditions. Water quality samples collected during the first year of baseline monitoring were analyzed for parameters presented in Table 95. Field measurements of specific conductance (SC), pH, and water temperature also were collected at each station at the time of sampling.

Table 95. Surface Water Quality Parameters Analyzed in Initial Baseline Monitoring.

Field Parameters	Common Ions	Metals†	Others
pH	Calcium	Aluminum	Nitrite and Nitrate as N
Specific conductance	Magnesium	Antimony	Ammonia
Temperature (°C)	Sodium	Arsenic	Total Kjeldahl Nitrogen as N
	Potassium	Cadmium	Orthophosphate as P
	Carbonate	Chromium	Total phosphorous as P
	Bicarbonate	Copper	Total dissolved solids
	Chloride	Iron	Total suspended solids
	Sulfate	Lead	Turbidity
	Fluoride	Manganese	Hardness, as calcium carbonate
		Mercury	Alkalinity, as calcium carbonate
		Molybdenum	Oil and Grease‡
		Silver	
		Zinc	

†Samples were collected in the field and analyzed in the laboratory for total recoverable metal concentrations. Total recoverable metals were analyzed in the laboratory using procedures described in EPA 600/4-79-020.
‡Oil and Grease was analyzed once for each surface water site to establish baseline conditions.
Source: Geomatrix 2006d.

Subsequent to the first year of baseline monitoring, Noranda established an "interim" monitoring program to continue baseline monitoring of surface water from April 1989 through November 1997 (Chen-Northern, Inc. 1990, 1991, 1992, 1993; Huntingdon Engineering & Environmental, Inc. 1994, 1995; Maxim Technologies, Inc. 1996, 1997, 1998). MMC collected four surface water samples in October 2004 to verify Noranda's data. During the interim monitoring period, water samples also were collected of discharge from the Libby Adit. These adit water sampling events occurred from 1993 through 1998 and in 2006 (Geomatrix 2006d).

Parameters analyzed in surface water samples collected during the interim period generally were similar to those sampled during the initial baseline monitoring period. From 1992 through 1994, four additional metals (antimony, beryllium, nickel, and thallium) were added to the analytical parameter list. Beginning in 1995, surface water samples were only analyzed for nitrate+nitrite, ammonia, SC, and pH.

Surface water samples also were collected in the East Fork Rock Creek and East Fork Bull River watersheds in 1998 to 2000 (Gurrieri 2001) and in 2005 (Geomatrix 2006a). In addition, the Northern Region of the Forest Service is conducting a long-term air quality study using high mountain lakes as barometers of change. The study began in 1992 and includes the Upper and Lower Libby Lakes. The purpose of the study is to provide a chemical record of air pollution impacts to the Libby Lakes and other northwest wilderness lakes that are sensitive to acid precipitation (Story, pers. comm. 2006). The Forest Service also collected surface water samples from Little Cherry Creek (at the LC-100 location) in 1962 through 1965, from Miller Creek in 1977 to 1982 and in West Fisher Creek from 2001 to 2006 (Wegner, pers. comm. 2006d). The KNF has been collecting surface water samples from East Fork Rock Creek and the East Fork Bull River from 1994 through 2006 (Neesvig, pers. comm. 2006).

3.12.2.3 Impact Analysis

3.12.2.3.1 Analysis Approach

A mass balance approach was used to predict potential water quality changes resulting from mine drainage wastewater discharge. Mass balance calculations were completed for three streams near where discharges would occur: Libby, Poorman, and Ramsey creeks. The mass balance calculations provide predicted concentrations, after mixing, of total dissolved solids, ammonia, nitrate, copper, iron, manganese, and zinc. Predicted concentrations of other metals were not developed because the estimated median concentrations of these metals in receiving streams (Table 96 and Table 97) and estimated average concentrations in wastewater (Table 100) were less than detection limits, but greater than water quality standards or the BHES Order limits. Thus, no conclusions could be made if mass balance analyses were completed. These metals are not discussed further.

Temperature is an important criterion for aquatic life and Montana has a surface water standard for temperature (Table 94). Stream temperatures may potentially be affected only if discharges were made directly to surface water. Temperature was not included in the mass balance calculations because the temperature of any discharge to surface water is not known. If a discharge to surface water were needed in any alternative, a MPDES permit limit for temperature would be set at a level protective of aquatic life. Temperature is not discussed further.

Streamflows used for the calculations were calculated $7Q_{10}$ flows (see next section 3.12.2.3.2, *Water Quantity*). Discharge rates used in the mass balance calculations are provided in Appendix G

Stormwater runoff events associated with storms exceeding the 10-year/24-hour storm (the design capacity of the stormwater retention ponds) were not analyzed. The water quality of both the storm runoff and the storm flows of the receiving streams are unknown. Therefore, a qualitative analysis of possible changes in stream water quality during storm runoff events was completed. Streamflows would be very high during such an event, with discharges to Poorman and Ramsey creeks likely less than 5 percent of the peak flow. Any discharges from stormwater retention ponds would be sampled and regulated.

For springs and lakes, for which changes in flows or lake levels could not be quantified, a qualitative analysis of possible changes in spring or lake water quality was completed. Limited data are available on the relative contribution of direct surface runoff, shallow ground water, and deeper bedrock ground water, and the water quality of each source to surface water at specific locations. Therefore, surface water quality changes to streams, springs, and lakes due to reduced contributions from deeper bedrock ground water were evaluated qualitatively.

Changes in surface water quality due to diversions of streamflows near the tailings impoundment also were evaluated qualitatively. Potential changes to surface water quality due to construction and maintenance of the transmission line also were evaluated qualitatively because effects would be contingent upon the effectiveness of construction and post-construction BMPs at stream crossings and along access roads located adjacent to streams.

3.12.2.3.2 Water Quantity

The DEQ's standard surface water mixing zone rules (ARM 17.30.516) require the use of the $7Q_{10}$ flow to assess effects of discharges that may affect surface water. The method used to calculate $7Q_{10}$ flow was developed by the USGS (Hortness 2006) (Appendix G). The calculated $7Q_{10}$ flows for analysis area monitoring locations were:

- 1.38 cfs for Ramsey Creek at RA-400
- 1.46 cfs for Ramsey Creek at RA-600
- 0.97 cfs for Poorman Creek at PM-1000
- 0.99 cfs for Poorman Creek at PM-1200
- 2.22 cfs for Libby Creek at LB-300
- 4.85 cfs for Libby Creek at LB-800
- 6.54 cfs for Libby Creek at LB-1000
- 7.25 cfs for Libby Creek at LB-2000

With the exception of stormwater runoff, water not used for mining and milling operations in Alternative 2 would be applied to the LAD Areas. Applied water that was not evapotranspired would percolate to ground water. Also, some seepage from the tailings impoundment not intercepted by the underdrain system would percolate to the ground water table. Below the LAD Areas, ground water mixed with applied water would migrate to adjacent streams. Below the tailings impoundment, such water would be captured by a pumpback well system before reaching surface water and returned to the tailings impoundment. Section 3.10.4.2.3, *LAD Areas* provides

the agencies' analysis of the maximum possible application rate of wastewater that could occur to the LAD Areas based on guidance documents from the Corps and EPA (U.S. Army Corps of Engineers 1982b; Environmental Protection Agency 2006b) and limitations due to the hydrologic characteristics of subsurface unconsolidated materials. The maximum application rate to the LAD Areas that the agencies estimated would be 130 gpm for Alternative 2 and 198 gpm for Alternatives 3 and 4. The application rate was used in the agencies' analysis of effects; application rate would vary and would be based on compliance with water quality standards, BHES Order limits, and MPDES permit limits. For Alternatives 3 and 4, the agencies assumed pretreatment of nitrate, with a removal rate of 90 percent. The agencies' analysis assumed nitrate concentrations in mine and adit wastewater discharges from the mine and adits would be 2.5 mg/L for Alternatives 3 and 4 instead of 25 mg/L used in Alternative 2. Concentrations of all other parameters were assumed to be the same as Alternative 2.

3.12.2.3.3 Receiving Stream Existing Water Quality

For the mass balance analyses, estimates of the existing water quality of the streams that would receive mine drainage wastewater discharges were derived from baseline surface water monitoring data collected from 1983 to 2006 (Geomatrix 2007f). A median concentration of each parameter was calculated (Table 96 and Table 97). The detection limit was used when the reported concentration was below the detection limit. Nitrate and ammonia data for LB-300 and LB-800 between January 1990 and December 1995 were not used in the analysis. Noranda started Libby Adit construction and discharges in January 1990, and nitrate and ammonia concentrations in Libby Creek may have been affected by discharges through December 1995, and were not used in the analysis. Nitrate was not measured in any sample from LB-1000; the median concentration (0.05 mg/L) between upstream station LB 800 and downstream station LB 2000 was used. Antimony was not analyzed in any sample from RA 600; the median concentration (<0.003) in other samples from Ramsey Creek was used in the analysis.

3.12.2.3.4 Wastewater Quality

The agencies used the best available information in developing estimates of wastewater quality (Table 100). In the 1990s, Noranda sampled Libby Adit inflows during and after adit construction ceased in November 1991. Samples were analyzed for temperature, pH, anions and cations, and selected metals. These data were supplemented with data collected by the DEQ in the 1990s and by MMC in 2006. Concentrations of nitrates and ammonia were based on estimates developed by MMC (Geomatrix 2007a). The best available data for tailings water are the concentrations shown in Tables 4-18 and 4-19 of the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001). The data in these two tables were averaged to develop an estimate of tailings water quality. Tables 4-18 and 4-19 of the Rock Creek Project Final EIS did not report a total dissolved solid concentration. The agencies used a total dissolved solid concentration of 200 mg/L in tailings seepage developed by MMC (Geomatrix 2007a). The best available data for mine wastewater quality are samples collected by Genesis, Inc. at the Troy Mine (Genesis, Inc. 2001, 2002). The mine had been in a temporary closure phase since 1993, so the water in the tailings pond was largely derived from discharge of water from the underground mine workings during this period. Several underground sources also were sampled separately during this period. The most representative samples came from the decant pond, which received all mine water when the mine did not operate (Jepson, pers. comm. 2008). For all wastewater discharges, the agencies used dissolved metals data in developing average concentrations because discharges would be either to the LAD Areas, or the water treatment plant would have a filtration process prior to discharge.

When parameter concentrations were reported as less than the detection limit, the detection limit was used in calculating average values.

3.12.2.4 Uncertainties Associated with the Water Quality Assessment

Changes in surface and ground water quality were projected using an analytical technique known as a chemical mass balance analysis. The mass balance analysis estimates the changes in concentrations of metals and other constituents in a receiving stream when discharges from the proposed operation are added. Projected changes in ground water concentrations are calculated in a similar manner. This projection assumes complete mixing of the discharged wastewater and ambient receiving waters. Variables used in the mass balance analysis include flow rate and ambient water quality in the receiving stream, and information on the rate and water quality of the proposed discharges.

The mass balance analysis uses the estimated wastewater quality shown in Table 100 and the discharged quantities provided in MMC's water balance for Alternatives 2 and 4 and the agencies' water balance for Alternatives 3 to predict the resulting water quality after mixing with ambient water quality at low flows. For water applied to the LAD Areas, concentrations would change due to mixing with precipitation and evapotranspiration, as described in section 3.12.2.3, *Impact Analysis*. Average precipitation and evapotranspiration rates for the 6-month growing season were used. The agencies assumed that the quality of precipitation in the LAD Areas is very good, with very low metals and total dissolved solids concentrations. Average nitrogen concentrations were available for precipitation in the analysis area (National Atmospheric Deposition Program 2008; Nanus *et al.* 2003).

Projections of surface water quality involve a number of uncertainties. These include the ambient and discharge water qualities, ambient water quantities, discharge water quantities, effectiveness of mixing in the stream, the exact location where surface water would be affected, effectiveness of treatment of the various water quality parameters by land application, and the environmental effect from increased metals concentrations on aquatic life. Because of the complexity of the water quality assessment, each of these uncertainties is discussed briefly in the following sections. Although discussed under surface water, most of these uncertainties also apply to the ground water impact assessment.

3.12.2.4.1 Ambient Water and Wastewater Quality

The quality of ambient water and wastewater frequently cannot be definitively determined because reported water quality concentrations for many parameters, particularly metals, are below the analytical detection limits. Parameters with concentrations reported with a "less than" symbol (<) are those parameters with concentrations below the detection limit used for the parameter at the time of the analysis. Quantifiable concentrations of these parameters are unknown. For concentrations reported with a less than symbol, the value shown is the "detection limit" obtained by the analytical laboratory when analyzing the water sample.

The detection limit is the lowest concentration of a parameter detectable by a laboratory using a particular analytical procedure. Different parameters and different samples have had different detection limits in past analyses. For example, a laboratory analyzing surface water samples may have used an analytical method having a detection limit of 0.001 mg/L for lead and 0.0001 mg/L for cadmium. When a concentration is reported at less than the detection limit (<0.001 mg/L for lead, for example), the actual concentration is unknown. In the case of lead, the actual

concentration could be 0.0009 mg/L (just less than the detection limit), or it could be 0.000009 mg/L, (a hundred times less than the detection limit). In developing estimates of ambient water and wastewater quality, the agencies used the detection limit in calculating a median concentration when the reported concentration was below the detection limit.

Lab data reported as less than detection limits pose three difficulties for loading analyses. First, if a concentration of a metal is below the detection limit, the actual concentration is not absolutely known. If MMC's discharges have concentrations reported as less than detection limits, changes in water quality may not be detectable. Second, surface water quality standards for some parameters, such as silver, are lower than the detection limit. It is not known, and cannot be known using approved analytical methods, whether surface water quality standards for silver and some other metals are being exceeded under ambient conditions, or whether surface water quality standards would be exceeded as a result of MMC's proposed discharges having concentrations below detectable levels. Third, the use of values equivalent to the detection limit in the loading analysis may overestimate or underestimate projected concentrations. Other methods for handling below detection limit data have been proposed, but such methods are typically used on larger data sets and data sets with more consistent detection limits within the data set. MMC would use lower, more sensitive detection limits during construction, operational, and post-operational monitoring than were used in the past.

For all assessment locations, median concentrations of all samples collected at a particular location were used to represent concentrations during low flow conditions. Median concentrations may be higher or lower than actual concentrations during low flow periods. For example, concentrations of total dissolved solids may be greater during low flow periods. Projected final mixing concentrations would be greater if the ambient low flow concentration is higher than the median concentration of all the samples or lower if the ambient low flow concentration is lower.

3.12.2.4.2 Nitrate and Ammonia Concentrations

Nitrate and ammonia concentrations (reported as N [nitrogen]) of the wastewater from the mine and adits are not known. Using best professional judgment, MMC provided estimated nitrate and ammonia concentrations from blasting. For water pumped from construction adits and mine workings, the estimated nitrate concentration range is 15 to 25 mg/L and the ammonia concentration range is 5 to 10 mg/L. Data from the Libby Adit during the construction by Noranda and from the nearby Troy Mine show a wide range of nitrate and ammonia concentrations during construction. MMC anticipates, and the agencies concur, that proper management of explosives and use of emulsions would reduce nitrate concentrations from those detected during the Libby Adit construction. Additional data on nitrate and ammonia concentrations would be collected during the Libby Adit evaluation program in accordance with MMC's existing MPDES permit.

The agencies used the Libby Adit water quality data collected by Noranda after adit construction ceased and nitrate and ammonia concentrations were not affected by blasting to develop an estimate of nitrate and ammonia concentrations in wastewater from post-construction adits. The average nitrate concentration is estimated to be <0.21 mg/L and the average ammonia concentration is <0.06 mg/L in wastewater from post-construction adits.

3.12.2.4.3 Ambient Water Quantity

Surface water low-flow conditions are conservative situations for assessing impacts from pollutant discharges. For the mass balance analysis, calculated $7Q_{10}$ values were used for

assessing potential impacts to surface water quality (see section 3.12.2.3, *Impact Analysis*). Use of a $7Q_{10}$ flow is consistent with the DEQ's standard surface water mixing zone rules (ARM 17.30.516). Measured low flows (Table 84), during which maximum pollutant concentrations may occur, are lower than the calculated $7Q_{10}$. Flows lower than the $7Q_{10}$ would result in higher instream concentrations than projected, if other assumptions in the mass balance analysis remain constant.

A ground water flux beneath the two tailings impoundment sites and LAD Areas was calculated for assessing impacts to ground water. MMC's and the agencies' estimates of ground water flux are based on available data in the two tailings impoundment sites and LAD Areas. Ground water flux is discussed in sections 3.10.4.2.2, *Tailings Impoundment* and 3.10.4.2.3, *LAD Areas*. To derive ground water flux, estimates of ground water gradient and hydraulic conductivity are required. If actual conductivities or gradients were higher than estimated, lower ground water concentrations than those projected would occur.

3.12.2.4.4 Wastewater Quantity

Projected wastewater quantity is based on the estimated water balance for each alternative. MMC's and the agencies' water balances are point estimates developed using reasonable methods and assumptions. Actual flow rates for a number of water sources described by the water balance, such as mine and adit inflows, precipitation and evaporation, and dust suppression, would vary seasonally and annually from the rates shown in the estimated water balances. Actual inflows without grouting could be considerably different than those estimated. The estimates are for "steady-state" conditions, or conditions that would occur over the long term. Initial inflows would be higher than steady-state conditions because water stored in saturated fractures and faults would be initially drained. It is not possible to accurately predict actual "steady-state" adit inflows. Mine inflow estimates have the same uncertainty.

The agencies used mine and adit inflows of 1,200 gpm to assess impacts to surface and ground water quality. MMC requested the use of 1,200 gpm to assess storage and discharge requirements; such a rate likely would be a maximum inflow rate that may occur during relatively short-term dewatering of fractures (see section 3.10.3.1.2, *Conceptual Model of the Mine-Area Bedrock Hydrogeology*). Except for short-term elevated inflow rates from initial dewatering of fractures, the steady-state long-term inflow rates for the mine and adits are estimated to be 600 to 800 gpm (Geomatrix 2007c). The agencies' numerical model estimated the steady-state long-term inflow rates for the mine and adits to be 450 gpm. It is very unlikely that a inflow rate of 1,200 gpm would occur on a sustained basis throughout the project. The amount of wastewater that would be discharged to the LAD Areas is independent of the mine and adit inflow rates. The agencies' estimate of the discharge rate to the LAD Areas is discussed in section 3.10.4.2.3, *LAD Areas*.

Because of uncertainties in the operational water balance and the discharge rates, the agencies would require extensive monitoring of operational flows and discharges. This may require long-term monitoring after mine closure. If the actual discharge rates were different than currently estimated, a new mass balance analysis would be performed to determine if additional mitigations would be required.

3.12.2.4.5 Water Quality Assessment Locations

Some uncertainty is associated with how and where streams would be affected by discharges from the LAD Areas. In projecting impacts on surface water quality, the agencies chose monitoring stations on Ramsey Creek, Poorman Creek, and Libby Creek, some of which are

long-term water quality monitoring sites. A station on Libby Creek (LB-1000) was used to assess the effects of all discharges. For example, a certain percentage of the discharge water from LAD Areas 1 and 2 for Alternative 2 was assumed to flow to Ramsey Creek, Poorman Creek, or Libby Creek based on site topography; the actual rate of discharge to each stream may be different. In addition, the locations in each stream at which water from the LAD Areas would discharge may be above or below the monitoring locations used for this impacts analysis (Figure 76).

3.12.2.4.6 Land Application Treatment

Land application treatment is very site- and effluent-specific. The amount of precipitation that occurs on a land treatment site, the quality of the precipitation and the rate of evapotranspiration from the land treatment site are variable and uncertain. Many factors affect treatment effectiveness (see section 3.12.4.2.2, *Effects of Discharges*). It is not possible to estimate actual removal rates for total dissolved solids, nutrients, and metals until mine wastewater application to the LAD Areas occurs and monitoring data are collected. The percent removal values used for total dissolved solids, nitrogen, and metals are uncertain (see section 3.12.4.2.2, *Effects of Discharges*). For the analysis of the effects of land application of wastewater, it was assumed that there would be no operational issues at the LAD Areas, such as uneven application of wastewater or runoff from the site directly to streams prior to treatment. It was also assumed that the treatment rates would not change over time, which may be realistic if LAD sites are properly monitored, inspected and maintained.

3.12.2.4.7 Time

For the water quality impact analysis, it was assumed that the percolation of treated ground water from the LAD Areas would be essentially a direct discharge into the receiving stream. Depending on the effective porosity of the aquifer under the LAD Areas (which is unknown, but estimated) and the actual flow path, the water treated at the LAD Areas may take from less than a year up to 10 years to reach receiving streams (see section 3.10.4.2.3, *LAD Areas*).

3.12.2.4.8 Environmental Effects on Aquatic Life

There is some uncertainty associated with the concentrations at which metals affect aquatic life in the analysis area. Montana surface water quality standards shown in Table 94 are based on a hardness of 25 mg/L as calcium carbonate ($CaCO_3$); actual hardness in area streams ranges between about 5 and 25 mg/L. Environmental effects on aquatic life from those metals that are hardness-related (cadmium, chromium, copper, lead, nickel, and silver) may occur at concentrations less than those shown in Table 94.

3.12.3 Affected Environment

3.12.3.1 Streams

Median surface water quality during the baseline monitoring period of the mine area streams is summarized in Table 96 and Table 97. Surface waters are a calcium bicarbonate-type water. Total suspended solids, total dissolved solids, major ions, and nutrient concentrations are all low, frequently at or below analytical detection limits. Generally, total dissolved solids concentrations, major ion concentrations, and concentrations of some minor ions such as iron increase downstream in Libby Creek and its tributaries. The highest median total dissolved solids concentrations in the analysis area were found at the downstream station in Little Cherry Creek and in the East Fork Bull River.

Table 96. Median Concentrations of Various Parameters at Sampling Sites in Ramsey Creek, Poorman Creek, and Little Cherry Creek.

Parameter (mg/L unless otherwise noted; see footnote)	RA-600			PM-1000			LC-800		
	Median Conc.	No. Samples	No. BDL	Median Conc.	No. Samples	No. BDL	Median Conc.	No. Samples	No. BDL
Field Measurements and Physical Parameters									
Field Temperature (C)	4	24	0	6	27	0	9	14	0
Field pH (SU)	6.7	21	0	6.8	28	0	7.2	17	0
Lab SC (µmhos/cm)	14	24	0	24	29	0	59	15	0
Total dissolved solids	<13	24	1	<20	31	3	<38	17	1
Total suspended solids	<1	24	18	<1	31	28	<4	18	8
Anions and Cations									
Alkalinity, Total as $CaCO_3$	5	24	0	12	31	0	27	18	0
Alkalinity, Bicarbonate as HCO_3	6	23	0	14	30	0	30	18	0
Chloride	<1	24	19	<1	30	24	<1	16	9
Sulfate	<2	24	5	<2	30	7	<2	17	7
Calcium	<1	24	18	<3	31	1	5	18	0
Magnesium	<1	24	24	<1	31	20	<3	18	1
Potassium	<1	24	24	<1	31	29	<1	18	11
Sodium	<2	24	6	<2	31	13	<1	18	1
Hardness	<6	24	18	<9	31	7	<24	18	1

Note: Table continued on next page.

Parameter (mg/L unless otherwise noted; see footnote)	**RA-600**			**PM-1000**			**LC-800**		
	Median Conc.	**No. Samples**	**No. BDL**	**Median Conc.**	**No. Samples**	**No. BDL**	**Median Conc.**	**No. Samples**	**No. BDL**
Nutrients									
Nitrate + Nitrite, as N	<0.06	24	2	0.05	31	0	<0.02	18	10
Ammonia, as N	<0.05	24	17	<0.10	31	23	<0.05	18	8
Total Phosphorus	<0.005	24	11	<0.008	31	14	<0.010	18	6
Phosphorus - Ortho	<0.005	24	21	<0.024	31	26	<0.007	18	10
Total Recoverable Metals									
Antimony	NM	0	0	<0.003	9	9	<0.003	9	9
Arsenic	<0.005	24	24	<0.005	31	31	<0.005	18	18
Cadmium	<0.0002	24	8	<0.0001	31	16	<0.0001	18	14
Chromium	<0.02	24	24	<0.02	31	31	<0.01	18	17
Copper	<0.001	24	12	<0.001	31	18	<0.001	18	10
Iron	<0.05	24	22	<0.05	31	31	<0.08	18	5
Lead	<0.001	24	23	<0.001	31	29	<0.002	18	16
Manganese	<0.02	24	23	<0.02	31	31	<0.02	18	8
Mercury	<0.0002	24	21	<0.0002	31	28	<0.0002	18	17
Silver	<0.0002	24	21	<0.0002	31	29	<0.0002	18	15
Zinc	<0.02	24	21	<0.02	31	27	<0.02	18	15

Sampling station locations are shown on Figure 76.
Conc. = concentration.
No. Samples = number of samples analyzed for particular parameter; No. BDL = number of analyzed samples with concentrations below the detection limit; detection limit varied between sample events and parameter; detection limit used in calculating median when reported concentration was below the detection limit.
All values are in milligrams per liter (mg/L) unless noted in first column.
µmhos/cm= micromhos per centimeter; s.u. – standard units; °C = degrees Celsius; < = less than concentration shown; NM = parameter not measured.
Source: Geomatrix 2007f.

Table 97. Median Concentrations of Various Parameters at Sampling Sites in Libby Creek.

Parameter (mg/L unless otherwise noted; see footnote)	LB-300			LB-800			LB-1000			LB-2000		
	Median Conc.	No. Samples	No. BDL	Median Conc.	No. Samples	No. BDL	Median Conc.	No. Samples	No. BDL	Median Conc.	No. Samples	No. BDL
Field Measurements and Physical Parameters												
Field Temperature (C)	5	98	0	4	24	0	10	16	0	5	21	0
Field pH (SU)	6.7	85	0	6.8	23	0	7.1	15	0	6.8	19	0
Lab SC (µmhos/cm)	21	80	0	23	24	0	35	12	0	38	22	0
Total dissolved solids	<18	62	12	18	24	0	<30	12	1	26	22	0
Total suspended solids	<1	61	48	<1	24	16	<1	12	11	<1	22	13
Anions and Cations												
Alkalinity, Total as $CaCO_3$	4	62	0	9	24	0	17	12	0	19	22	0
Alkalinity, Bicarbonate as HCO_3	5	62	0	11	23	0	21	12	0	23	22	0
Chloride	<1	61	47	<1	24	22	<1	12	11	<1	22	20
Sulfate	<2	60	18	<1	24	9	<2	12	5	<2	22	8
Calcium	<2	62	7	<2	24	4	4	12	0	5	22	0
Magnesium	<1	62	42	<1	24	23	<2	12	1	<1	22	8
Potassium	<1	61	48	<1	24	23	<1	12	6	<1	22	15
Sodium	<1	62	22	<2	24	7	<1	12	4	<1	22	7
Hardness	<7	62	26	<8	24	15	18	12	0	<17	22	7

Note: Table continued on next page.

Parameter (mg/L unless otherwise noted; see footnote)	LB-300			LB-800			LB-1000			LB-2000		
	Median Conc.	No. Samples	No. BDL	Median Conc.	No. Samples	No. BDL	Median Conc.	No. Samples	No. BDL	Median Conc.	No. Samples	No. BDL
Nutrients												
Nitrate + Nitrite, as N	<0.12	35	2	0.04	17	0	NM	0	0	0.06	2	0
Ammonia	<0.05	35	32	<0.05	24	15	<0.05	15	12	<0.05	22	16
Total Phosphorus	<0.006	59	23	<0.005	24	10	<0.006	12	5	<0.005	22	9
Phosphorus - Ortho	<0.005	61	48	<0.005	24	18	<0.005	12	11	<0.005	22	19
Total Recoverable Metals												
Antimony	<0.003	12	12	NM	0	0	<0.004	2	2	<0.002	1	1
Arsenic	<0.005	62	62	<0.005	24	24	<0.005	12	12	<0.005	22	22
Cadmium	<0.0001	62	49	<0.0002	24	10	<0.0001	12	11	<0.0001	22	15
Chromium	<0.02	62	61	<0.02	24	24	<0.02	12	12	<0.02	22	22
Copper	<0.001	62	30	<0.001	24	13	<0.001	12	6	<0.001	22	9
Iron	<0.05	62	54	<0.05	24	16	<0.05	12	9	<0.05	22	13
Lead	<0.001	62	54	<0.001	24	22	<0.001	12	10	<0.001	22	11
Manganese	<0.02	62	60	<0.02	24	24	<0.02	12	12	<0.02	22	21
Mercury	<0.0002	62	54	<0.0002	24	22	<0.0002	12	11	<0.0002	22	19
Silver	<0.0002	62	41	<0.0002	24	23	<0.0002	12	7	<0.0002	22	16
Zinc	<0.02	62	43	<0.02	24	21	<0.02	12	8	<0.02	22	16

Sampling station locations are shown on Figure 76.
No. Samples = number of samples analyzed for particular parameter; No. BDL = number of analyzed samples with concentrations below the detection limit; detection limit varied between sample events and parameter; detection limit used in calculating median when reported concentration was below the detection limit.
All values are in milligrams per liter (mg/L) unless noted in first column.
µmhos/cm= micromhos per centimeter; s.u. – standard units; °C = degrees Celsius; < = less than concentration shown; NM = parameter not measured.
Source: Geomatrix 2007f.

Metal concentrations are generally low. Aluminum, arsenic, chromium, manganese, mercury, and zinc concentrations were often reported as less than the detection limits. Detectable levels of iron, copper, and silver were reported at most sampling stations. Detectable metal concentrations are probably related to local geology and mineralization. Seasonal variations are present in the baseline surface water quality data. Nutrient concentrations increase during spring runoff. Total dissolved solids decrease during spring runoff and increase during low flow periods. Total suspended solids increase during spring runoff.

Analysis area streams are poorly buffered due to low alkalinities. Consequently, surface waters tend to be slightly acidic, with most pH values slightly below 7.0. This acidity has two likely natural sources: organic acids originating from surrounding coniferous forests and dissolved carbon dioxide (CO_2) in surface and ground water draining into the area streams. Median water hardness in all sampled streams within the Libby Creek drainage was less than 30 mg/L, with several sampling locations reporting median hardness values less than 10 mg/L.

The water quality of the East Fork Rock Creek is very similar to that of the Libby Creek drainage, with low specific conductance values, low suspended solids concentrations, a hardness averaging 13 mg/L, and low nutrient and metals concentrations. The East Fork Bull River is also of good quality, but is more alkaline and has slightly higher total dissolved and suspended solids concentrations, a median hardness of about 23 mg/L, and low nutrient and metals concentrations.

3.12.3.2 Lakes

Lakes located in or near the CMW have excellent water quality. Several water samples were collected from 1998 to 2000 and in 2005 from inflow and outflow from Rock Lake (Geomatrix 2006a). The Northern Region of the Forest Service is conducting a long-term air quality study using high mountain lakes as barometers of change. This includes Upper and Lower Libby Lakes, located over the ore body. Ammonia, chloride, nitrate, sulfate, phosphorus, pH, SC, acid neutralizing capacity, and several common ions were measured in these lakes between 1994 and 2004. Available water quality values for Rock Lake and Libby Lakes are provided in Table 98. An investigation of Rock Lake completed in 1999 (Gurrieri and Furniss 2004) found that during the ice-free season, ground water contributed 71 percent of the minerals to the lake, surface water contributed 25 percent, and rainfall contributed 4 percent. The Libby Lakes are extremely dilute and very vulnerable to acid deposition (Story 2006). For this reason, they have been and continue to be monitored annually.

Seasonal variations in the water quality of Rock Lake indicate that the volume of inflow from various sources (snowmelt, rainfall, shallow and deep ground water) varies proportionally during the year. Because the watershed above Rock Lake consists of highly resistant bedrock with little vegetation and soil cover, snowmelt and surface water entering the lake is very diluted.

Table 98. Average Baseline Water Quality for Analysis Area Lakes.

Sample Site	Upper Libby Lake	Lower Libby Lake	Rock Lake	St. Paul Lake
Sample dates	7/92 to 7/04	7/94 to 7/04	7/22/99 to 10/22/99	10/3/01
No. of Samples	14	13	6	1
Field Measurements and Physical Parameters				
pH (s.u.)	5.68	6.04	6.4	6.7
Specific conductance (µmhos/cm)	2.4	3.84	6.8	18.2
Anions and Cations (mg/L)				
Chloride	0.11	0.18	0.049	0.072
Sulfate	1.12	0.25	0.267	0.450
Calcium	0.09	0.18	0.671	2.387
Magnesium	0.02	0.05	0.178	0.621
Hardness as $CaCO_3$	0.72	0.3	2.4	8.5
Sodium	0.14	0.29	0.148	0.309
Potassium	0.06	0.10	0.111	0.189
Nutrients (mg/L)				
Nitrate	0.08	0.02	0.047	<0.010
Ammonia	0.02	0.03	0.02	<0.010
Orthophosphate	<0.01	<0.01	<0.01	<0.01

mg/L = milligrams per liter, µmhos/cm= micromhos per centimeter, s.u. = standard units, °C = degrees Celsius.
Source: Gurrieri and Furniss 2004; Geomatrix 2006d; Story, pers. comm. 2006.

3.12.3.3 Springs

All ground water in the analysis area is the result of infiltration of precipitation and the reported water quality indicates that percolating ground water gradually becomes more mineralized as it moves through the various geologic formations, without changing water types. This water quality transition is a good indicator of the source of ground water to a given spring. Water quality analyses were completed on samples from springs in the Little Cherry Creek watershed, the Poorman Tailings Impoundment Site, and in the CMW (Table 99, Figure 71, and Figure 72). Springs from all areas are mostly calcium bicarbonate water, but some are sodium bicarbonate water. Springs with higher total dissolved solids and metals concentrations (*e.g.*, SP-14 and SP-30) indicate longer subsurface flow paths than other springs. A spring located directly above Rock Lake (SP-1R) appears to receive mostly shallow ground water, whereas a spring below Rock Lake (SP-3R) appears to receive a combination of shallow and deeper ground water. Several of the springs sampled in 2007 in the Poorman Tailings Impoundment Site had elevated suspended sediment concentrations, indicating that the samples were not filtered; it is likely that elevated metal concentrations in these springs are associated with the sediment in the water.

Table 99. Average Baseline Water Quality for Mine Area Springs.

Sample Site	SP-1R	SP-4/4R	SP-05/3R	SP-10	SP-11	SP-12	SP-13	SP-14	SP-15	SP-21	SP-25	SP-26	SP-27	SP-28	SP-30	SP-32
Watershed	East Fork Rock Creek	East Fork Rock Creek	East Fork Rock Creek	Little Cherry Creek	Bear Creek	Little Cherry Creek	Bear Creek	Libby Creek	Little Cherry Creek	Ramsey Creek	Libby Creek	Unnamed (Poorman Impound-ment Site)	Poorman Creek	Unnamed (Poorman Impound-ment Site)	Unnamed (Poorman TI site)	East Fork Bull River
Sample dates	10/98 – 9/05	8/88 – 9/05	8/88 – 10/99	7/89	7/89	7/89	7/89	7/89	7/89	8/07	8/07	8/07	8/07	8/07	8/07	9/06
No. Samples	4	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Field Measurements and Physical Parameters																
Flow (gpm)	1-10	5-20	NM	NM	NM	NM	NM	NM	NM	1	5	0.5	2	4	5	-
Temperature (°C)	5	7	9	NM	NM	13	NM	NM	5	25.3	13	13.6	12.1	14.7	24	-
pH	6.5	7.1	6.9	6.4	7.2	5.8	7.2	NM	7.1	6.43	6.89	7.74	6.95	8.29	8.29	7.7
Specific conductance (µmhos/cm)	13	21	24	91	68	42	138	226	18	88	37.9	219.2	14.9	334	315	87
Total dissolved solids	9	20	17	97	79	86	91	154	<20	84	<10	<10	49	<10	173	-
Total suspended solids	NM	NM	NM	NM	NM	NM	NM	NM	NM	47.5	<1	79.8	<1	<1	<1	-
Anions and Cations																
Alkalinity	<76	<9	13	49	39	22	68	115	7	13	8	110	7	169	160	-
Bicarbonate	<1	<11	16	60	48	27	83	140	9	<1	<1	<1	<1	<1	<1	-
Chloride	<1	<1	<1	1	<1	1	<1	1	<1	1	1.6	1.4	1	1	<1	-
Sulfate	<2	<3	2	3	2	2	2	<1	<1	<5	<5	<5	<5	<5	<5	-
Calcium	1	<2	2	10	12	6	18	30	1	6.35	1.3	29.5	1	50.6	42.3	-
Magnesium	<1	<1	<1	5	2	1	5	8	<1	2.5	0.26	9.9	0.3	13.3	13.6	-
Sodium	<0	<1	<1	1	<1	<1	<1	<1	<1	7.25	1.7	3.2	1	2.5	2.6	-
Potassium	<1	<1	<1	2	<1	2	<1	6	<1	0.84	0.4	0.735	0.6	0.9	0.6	-
Hardness	NM	<5	<7	46	38	19	66	108	<7	26	4	114	4.6	181	161	-

Note: Table continues on next page.

Sample Site	SP-1R	SP-4/4R	SP-05/3R	SP-10	SP-11	SP-12	SP-13	SP-14	SP-15	SP-21	SP-25	SP-26	SP-27	SP-28	SP-30	SP-32
Watershed	East Fork Rock Creek	East Fork Rock Creek	East Fork Rock Creek	Little Cherry Creek	Bear Creek	Little Cherry Creek	Bear Creek	Libby Creek	Little Cherry Creek	Ramsey Creek	Libby Creek	Unnamed (Poorman Impound-ment Site)	Poorman Creek	Unnamed (Poorman Impound-ment Site)	Unnamed (Poorman TI site)	East Fork Bull River
Sample dates	10/98 – 9/05	8/88 – 9/05	8/88 – 10/99	7/89	7/89	7/89	7/89	7/89	7/89	8/07	8/07	8/07	8/07	8/07	8/07	9/06
No. Samples	4	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Nutrients																
Nitrate + Nitrite, as N	1.01	0.03	0.18	0.01	<0.01	<0.01	<0.05	<0.01	<0.07	0.224	0.7	0.82	0.225	<1	<1	-
Ammonia	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.45	<0.05	<0.05	0.34	<0.05	0.35	-
Total phosphorus	NM	NM	NM	NM	NM	NM	NM	NM	NM	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Orthophosphate	NM	NM	NM	NM	NM	NM	NM	NM	NM	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Total Recoverable Metals																
Arsenic	NM	<0.005	NM	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	-
Cadmium	NM	<0.001	NM	<0.0009	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0001	<0.00008	0.0001	<0.00008	0.0001	<0.00008	-
Chromium	NM	<0.02	NM	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Copper	NM	<0.02	NM	<0.017	<0.010	<0.010	<0.010	<0.010	<0.010	0.005	<0.001	0.005	0.001	<0.001	<0.001	<0.001
Iron	NM	<0.05	NM	<0.05	<0.05	0.36	<0.05	0.67	<0.05	16	<0.01	0.789	0.017	<0.01	0.086	
Lead	NM	<0.01	NM	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.0005	0.005	0.003	<0.0005	0.005	<0.01
Manganese	NM	<0.02	NM	<0.02	<0.02	<0.02	<0.02	0.71	<0.02	1.22	<0.005	0.22	<0.005	<0.005	0.014	-
Mercury	NM	<0.0002	NM	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	-
Silver	NM	<0.001	NM	<0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-
Zinc	NM	<0.02	NM	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

All units are milligrams per liter, except where noted; μmhos/cm= micromhos per centimeter, °C = degrees Celsius, NM = not measured
Detection limit used in calculating arithmetic average when the reported concentration was below the detection limit.
Not all samples analyzed for all analytes or parameters.
Spring locations are shown on Figure 71 and Figure 72 except for SP-25, which is located near Libby Creek about 0.5 mile below LB-300.
Source: Gurrieri 2001; Geomatrix 2006a, 2006d, and 2007a.

3.12.4 Environmental Consequences

This section describes the anticipated changes in surface water quality for each alternative. This includes analysis area streams, lakes, and springs. Potential direct effects of the project are described, as are potential cumulative effects that may occur as a result of the mine and transmission line alternatives and identified reasonably foreseeable actions.

3.12.4.1 Alternative 1 – No Mine

In this alternative, MMC would not develop the Montanore Project. Any existing exploration-related or baseline data collection disturbances by MMC would be reclaimed in accordance with existing laws and permits. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Water quality in surface waters would not change from existing conditions.

3.12.4.2 Alternative 2 – MMC Proposed Mine

Development of the Montanore Project would require construction of project facilities, such as a mill, tailings impoundment, adits, and access roads. In MMC's proposal, the mill and mine production adits would be located in upper Ramsey Creek, about 0.5 mile from the CMW boundary. An additional adit on MMC's private land in the Libby Creek drainage and a ventilation adit on MMC's private land east of Rock Lake would be used for exploration and ventilation (Figure 2). A tailings impoundment is proposed to be constructed in the Little Cherry Creek drainage, and would require the diversion of Little Cherry Creek. Two LAD Areas between Poorman Creek and Ramsey Creek are proposed to allow for discharge of excess mine water using sprinkler irrigation of water on the land surface. A portion of the waste rock resulting from adit development may be stored temporarily at LAD Area 1, and at the Libby Adit Site. Sanitary waste would be collected and shipped off-site for treatment and disposal. The total area of disturbance for Alternative 2 would be 2,582 acres.

3.12.4.2.1 Effects of Mine Inflows

Impacts to Streams

In the stream segments whose base flows would be reduced as a result of mining, water quality changes may occur. Because deeper ground water is likely to have higher total dissolved solids concentrations (generally greater than 100 mg/L) than shallow ground water or direct runoff to streams (generally less than 50 mg/L), a decrease in the deeper ground water contribution to streamflow may result in lower total dissolved solids concentrations in affected streams. Whether water quality changes in these streams would be measurable or could be separated from natural variability is unknown.

Impacts to Lakes and Springs

The Libby Lakes are located at an elevation of about 7,000 feet, perched above the ground water table. The lakes lie on a series of faults and vertically oriented bedding planes, but there are no observations, data, or numerical model results to indicate that the lakes are hydraulically connected to the deep bedrock ground water table. It is unlikely that the Libby Lakes would be affected by mining activities. Because deep bedrock ground water is a contributor to Rock Lake throughout the year (Gurrieri 2001), mining may affect the water quality of Rock Lake. Because

of subtle differences in the quality of shallow and deeper ground water, both of which are sources to Rock Lake (Gurrieri 2001), and limited baseline data for Rock Lake, it may be difficult to differentiate changes in water quality from pre-mining water quality variability. If less ground water were contributed to Rock Lake or St. Paul Lake, water in these lakes would become more dilute, with lower total dissolved solids concentrations. Reducing the source of deeper ground water could reduce the introduction of certain minerals considered to be necessary for potential populations of organisms (Gurrieri 2001, 2008). Whether water quality changes in either lake would be measurable or could be separated from natural variability is unknown, but collection and analysis of baseline, pre-mining data would provide useful information on the natural variability of the lakes. Lake monitoring is discussed in Appendix C.

Depending on the ratio between shallow and deep ground water contribution to area springs, water quality changes may be very slight and not measurable. In the case of springs that receive a large portion of their flow from deep ground water, total dissolved solids, which are the minerals dissolved in the water, may decrease as the shallow ground water accounts for a larger proportion of the total flow. The only springs whose water quality may be adversely affected by the mine, based on the agencies' numerical model, would be those located below an elevation of about 5,600 feet.

3.12.4.2.2 Effects of Discharges

Quality of Wastewater Sources

Discharges of wastewater would occur during construction, operations, and closure phases of the mine. Except for stormwater runoff, the discharges would be to ground water, which would then seep into stream channels, so erosion and sedimentation would not occur. The sources of the non-stormwater discharges would be mine and adit mine drainage water treated at the LAD Areas, mine drainage seepage from waste rock stockpiles and from the LAD Area sediment pond and, post-closure, water from the tailings impoundment treated at the LAD Areas. Stormwater discharges through the overflow pipes from the stormwater retention ponds when storms exceed the pond capacities would flow overland about 1,500 feet to surface water and may increase erosion and stream sedimentation. In addition, seepage from the unlined retention pond at the LAD Areas or excess application of water to the LAD Areas could result in increased runoff and/or the formation of new springs, which could increase erosion and stream sedimentation. For stormwater runoff, the source of water would be runoff that would be flowing either from the Ramsey Plant Site fill slope, or the LAD Area 1 Waste Rock Stockpile and the LAD Areas during events greater than the 10-year/24-hour design storm of 2.4 inches.

The average water quality of the discharge water from each of these sources is provided in Table 100. The reader is referred to section 3.12.2.4, *Uncertainties Associated with the Water Quality Assessment* regarding the uncertainties of the estimates provided in Table 100.

When mine and adit water was applied to the LAD Areas, it would mix with precipitation, and much of it would evapotranspire. The quality of the water before chemical and biological treatment within the plant root/soil matrix would change as a result of dilution by rain water, then concentration, as about 90 percent (on average) of this water would be lost to the atmosphere via evapotranspiration. Resultant nutrient and metal concentrations were calculated and used for the chemical mass balance analysis. The water would then be treated within the plant root/soil matrix.

Table 100. Average Expected Concentrations of Wastewater in Alternatives 2, 3, and 4 Used in Mass Balance Analyses.

Parameter	Source			
	Construction Adit Water	Post-Construction Adit Water	Mine Water	Tailings Water
Total dissolved solids	162	162	140	200
Nitrate/nitrite, as N	25	<0.21	25	16.1
Ammonia, as N	10	<0.06	10	7.3
Antimony	<0.003	<0.003	0.009	0.009†
Arsenic	<0.004	<0.004	<0.002	<0.005
Cadmium	<0.0003	<0.0003	<0.0002	<0.002
Chromium	<0.006	<0.006	<0.001	<0.001
Copper	<0.004	<0.004	0.045	0.035
Iron	<0.05	<0.05	0.03	<0.04
Lead	<0.004	<0.004	<0.002	<0.013
Manganese	<0.01	<0.01	0.044	0.54
Mercury	<0.0002	<0.0002	<0.0002	<0.001
Silver	<0.0007	<0.0007	<0.003	<0.004
Zinc	<0.03	<0.03	0.01	<0.02
Source	Geomatrix 2007f	Geomatrix 2007f	Genesis, Inc. 2000, 2001	USDA Forest Service and DEQ 2001

†Antimony concentrations not reported; mine water concentrations used.
Concentrations presented with a < symbol had at least one sample with a reported concentration less than the detection limit used in calculating arithmetic average values.
Detection limit used in calculating arithmetic average when reported concentration was below the detection limit.
All concentrations are in mg/L; all metal concentrations are for dissolved metals.

Land application can substantially reduce suspended sediment, nitrogen, and metal concentrations. Nitrogen removal occurs through vegetative uptake, biological reduction through nitrification/denitrification in the soil, and ammonia volatilization. The main concern associated with land application is the potential for nitrate to be transported to ground water (Environmental Protection Agency 2006b). Nitrate removal is site- and effluent-specific; removal depends on soil physiochemical properties, soil hydraulics, soil moisture, soil organic content vegetation types, slope, and temperature. Ammonia removal is by volatilization, uptake by vegetation, and adsorption by clay minerals in the soil; its removal depends on temperature, pH, soil characteristics and soil water content. Metals are removed by adsorption, precipitation, ion exchange, biogeochemical reactions, uptake by plants and microorganisms, and complexation (Environmental Protection Agency 2006b). Metal removal is site- and effluent-specific and depends on vegetation type, soil characteristics, pH, and temperature.

Due to the many variables that have not been specifically defined for the LAD Areas, specific percent removal rates for nitrate, nitrite, ammonia and metals could not be determined. The BHES Order requires the DEQ to review design criteria and final engineering plans to determine that at least 80 percent removal of nitrogen would be achieved by LAD treatment. Removal rates for ammonia, nitrate, and nitrite cannot be determined until LAD Area final engineering plans and

design criteria are submitted and monitoring data collection has commenced. Treatment rates for nitrogen compounds appear to vary widely, ranging from 50 to 90 percent for total nitrogen (Environmental Protection Agency 2002). Maximum nitrogen removal occurs when nitrogen is applied in the ammonia or organic form rather than the nitrate form (Georgia Department of Natural Resources 2006; Environmental Protection Agency 2006b). Ammonia represents the reduced (less oxidized) form of nitrogen, while nitrate represents the oxidized form. Ammonia is expected to be present in wastewater used on the LAD Areas. Nitrates are more readily taken up by plants, while ammonia is more readily adsorbed by soils.

In the agencies' analysis, land application treatment rates were assumed to be 50 percent for nitrogen (nitrate and ammonia) and iron. For zinc and manganese, a 10 percent removal was assumed, and for copper a 90 percent removal was assumed. A report prepared for Noranda (CDM 1991) on soil attenuation in the analysis area showed high copper attenuation in the analysis area soils. Zinc may be taken up by vegetation, but does not in general sorb readily on soils. Manganese also does not sorb readily on all soil types. In the agencies' analysis, it was assumed that 90 percent of the zinc and manganese percolated to ground water.

Chemical Mass Balance Calculations

Mass balance calculations were completed for the construction, operations, and post-mining periods. Effects to springs located close to the LAD Areas (such as SP-21), assuming that shallow ground water was a source of supply to such springs, would be similar to that calculated for ground water below the LAD Areas (Appendix G).

Predicted concentrations at RA-600, PM-1200, and LB-1000 without additional treatment beyond land application are provided in Table 101. Mass balance analyses for other locations in Ramsey, Poorman, and Libby creeks are provided in Appendix G. The projected final mixing concentrations for sites in Libby, Poorman, and Ramsey creeks were compared to the BHES Order nondegradation limits, where applicable, surface water standards, or ambient concentrations where ambient concentrations were greater than surface water standards. Nitrate and ammonia concentrations were added together to evaluate compliance with the BHES Order nondegradation limit for total inorganic nitrogen (TIN).

Table 102 provides a summary of predicted water quality exceedances for Alternative 2 due to wastewater discharge at the LAD Areas. If land application of excess water would result in water quality exceedances, MMC would treat the water at the Libby Adit Water Treatment Plant prior to land application. If needed, an additional water treatment facility may be required. Water discharged from the treatment facilities to a nearby stream would be required to meet the BHES Order nondegradation limits or water quality standards for all other parameters (Table 94). Seepage from the tailings impoundment would have to be captured prior to entering the creek to avoid water quality exceedances in former Little Cherry Creek.

Table 101. Predicted Concentrations with Land Application Treatment in Ramsey Creek at RA-600, Poorman Creek at PM-1200, and Libby Creek at LB-1000, Alternative 2.

Parameter	RA-600	PM-1200	LB-1000	Surface Water Standard or BHES Order Nondegradation Limit
During Construction				
Total dissolved solids	<30	<33	<45	100
Ammonia, as N	<0.59	<0.45	<0.24	TIN=1
Nitrate, as N	**<1.42**	**<1.06**	0.52	TIN=1
Total inorganic nitrogen	**<2.01**	**<1.51**	<0.76	TIN=1
Antimony	<0.003	<0.003	<0.004	0.0056
Copper	<0.001	<0.001	<0.001	0.003
Iron	<0.05	<0.05	<0.04	0.1
Manganese	<0.02	<0.02	<0.02	0.05
Zinc	<0.02	<0.02	<0.02	0.025
During Mining				
Total dissolved solids	<29	<32	<39	100
Ammonia, as N	<0.41	<0.32	<0.19	TIN=1
Nitrate, as N	<0.97	<0.73	<0.39	TIN=1
Total inorganic nitrogen	**<1.38**	**<1.05**	<0.58	TIN=1
Antimony	<0.003	<0.003	<0.004	0.0056
Copper	<0.001	<0.001	<0.001	0.003
Iron	<0.05	<0.05	<0.05	0.1
Manganese	<0.02	<0.02	<0.02	0.05
Zinc	<0.02	<0.02	<0.02	0.025
During Post-Mining				
Total dissolved solids	<34	<36	<39	100
Ammonia, as N	<0.45	<0.34	<0.21	TIN=1
Nitrate, as N	<0.93	<0.70	0.40	TIN=1
Total inorganic nitrogen	**<1.38**	**<1.04**	<0.61	TIN=1
Antimony	<0.003	<0.003	<0.004	0.0056
Copper	<0.001	<0.001	<0.001	0.003
Iron	<0.05	<0.05	<0.05	0.1
Manganese	**<0.07**	**<0.06**	<0.04	0.05
Zinc	<0.02	<0.02	<0.02	0.025

All concentrations are mg/L.
Predicted exceedances of BHES Order limits or surface water standards without additional treatment beyond land application are shown in **bold**.
TIN=total inorganic nitrogen.

Table 102. Water Quality Parameters that May Exceed Standards or BHES Order Nondegradation Limits due to Wastewater Discharge at the LAD Areas, Alternative 2.

Stream Monitoring Site	Construction	Mining	Post-Mining
RA-400	TIN	none	TIN, manganese
RA-600	TIN	TIN	TIN, manganese
PM-1000	none	none	none
PM-1200	TIN	TIN	TIN, manganese
LB-300	none	none	none
LB-800	none	none	none
LB-1000	none	none	none
LB-2000	none	none	none

Monitoring sites are shown in Figure 76.
Predicted exceedances based on no additional treatment beyond land application.
TIN=total inorganic nitrogen.

Post-Mining Water Quality

After the completion of mining and plugging of the adits, ground water that filled the mine void would have the potential to flow toward the East Fork Bull River drainage. Flow to the East Fork Bull River would not occur until the mine void completely filled with water and the ground water drawdown cone reached steady-state conditions, which may take about 70 years. The quality of the post-operational mine water may be equivalent to the post-operational Troy mine water quality, which is provided in Table 103. After the mine void filled, water traveling to the surface would move through about 3,000 feet or more of fractured bedrock material. Nutrient and metal concentrations in water in the mine void would decrease before reaching the surface due to dilution and sorption. The fate and transport of dissolved metals within the flooded mine void cannot be estimated without significant uncertainty, particularly considering the relatively low surface water standards. MMC intends to construct a ground water model during the mine development period to evaluate the potential for the migration of dissolved metals from the mine void to the East Fork Bull River. If the modeling indicates that surface water standards would be exceeded in the East Fork Bull River, mitigation measures would be implemented prior to completing the mine.

For adits from which water may discharge after mine closure, a water-retaining plug would be installed in competent bedrock. Design of the water-retaining plug would be determined by hydrologic and geotechnical data. Water-retaining plugs may be located deeper into the adit than a dry plug; thus, mine entries from the portal to the plug would be backfilled. Final plugging design for “wet” openings would be prepared for the agencies’ approval before cessation of operations.

The tailings would continue to consolidate and MMC would operate the seepage collection and pumpback well facilities until water quality standards, BHES Order limits, and MPDES permit limits were met without treatment. Long-term water treatment and surface and ground water quality monitoring may be required. The LAD Areas would continue to be used for water treatment; the application rate would be adjusted to meet MPDES permit effluent limits. If

necessary, additional water would be treated at the Libby Adit Water Treatment Plant or would be cycled within the tailings impoundment.

Table 103. Expected Post-Mining Water Quality.

Parameter	Average Concentration	Maximum Concentration
Total dissolved solids	140	171
pH	8.0	Min=7.6, Max=8.3
Total hardness	97	116
Sulfate	33	42
Ammonia, as N	<0.31	4.8
Nitrate/nitrite, as N	<0.63	1.5
Antimony	0.009	0.011
Arsenic	<0.002	<0.002
Cadmium	<0.0002	<0.0002
Chromium	<0.001	<0.001
Copper	0.045	0.049
Iron	<0.03	0.031
Lead	<0.002	<0.002
Manganese	0.044	0.065
Mercury	<0.0002	<0.0002
Silver	<0.003	<0.003
Zinc	0.01	0.013

All concentrations are in mg/L.
Detection limit used in calculating arithmetic average when reported concentration was below the detection limit.
Source: Genesis Inc. 2000, 2001.

3.12.4.2.3 Effects of Diversions and other Surface Disturbances

MMC's proposed measures to control runoff and sedimentation are described in section 2.4.2.5, *Fugitive Dust and Erosion* Control. Until vegetation ground cover reached predisturbance levels, erosion rates would be higher than before disturbance and may increase stream sedimentation in and downstream of the analysis area. MMC may conduct a sediment-source inventory in the watershed and stabilize, recontour and revegetate priority sediment source areas. If selected as part of the Fisheries Mitigation Plan, these measures would reduce sediment to area streams.

Except for sediment, the diversion of Little Cherry Creek would not affect the water quality of Little Cherry or Libby creeks during or after mining. The channel would be designed for the 100-year flow and be constructed of natural materials. The new channel would be constructed prior to diverting Little Cherry Creek. The constructed channel would be subject to erosion and sedimentation until vegetation stabilizes the stream banks and floodplain. The majority of sediment generated would occur during initial channel flush and subsequent high flow and rainfall events. In the event of heavy precipitation during channel construction, substantial erosion and short-term increases in sedimentation to the lower channel and Libby Creek may occur.

Channels A and B would receive water from the constructed Diversion Channel and the existing upper Little Cherry Creek watershed. They are not large enough to handle the expected flow volumes; these channels would contribute sediment to Libby Creek due to bank erosion and channel scouring. MMC would construct some bioengineered and structural features in the two channels to reduce flow velocities, and minimize erosion and sedimentation where access were possible to complete such work. MMC also would evaluate potential locations for creating wetlands in the floodplain of Libby Creek and ponds to capture and retain sediment from the two channels. After mining, runoff from the reclaimed Little Cherry Creek Tailings Impoundment would be routed toward Bear Creek. This may increase the potential for greater sedimentation in the Bear Creek channel, particularly during large runoff events. Greater sedimentation to Libby Creek within the upper 303(d)-listed segment may occur, which could cause channel aggradation, bank erosion and channel widening. One of the possible fisheries mitigation projects proposed by MMC would be to conduct a sediment-source inventory in the watershed, and stabilize, recontour, and revegetate priority source areas, which are typically road cuts and stream crossings in Libby, Hoodoo, Poorman, Midas, and Crazyman creeks. If implemented, this project would reduce the contribution of sediment from these sources to the Libby Creek watershed.

MMC's Stormwater Pollution Prevention Plan, described in Geomatrix (2007a), would be designed to minimize erosion and sedimentation from disturbed areas. The plan describes the potential sources of stormwater pollution, pollution prevention practices, sediment and erosion control measures, runoff management, inspections and reporting. BMPs would include ditches, sediment traps, and sediment retention ponds. The surface water monitoring program would include regular sampling for total suspended sediments and turbidity.

The agencies would institute a process to review and evaluate the final tailings impoundment design to ensure long-term stability, and minimize the probability of failure. Catastrophic failure of the tailings impoundment is considered a low-probability event (see section 3.9, *Geotechnical Engineering*). A failure modes effects analysis completed for the Little Cherry Creek impoundment estimated the risk of catastrophic failure as having a 0.1 to 1 percent chance of occurrence (Klohn Crippen 2005). Should such a failure occur, sediment and tailings leachate would be uncontrollably released to the environment. The volume of material released and the effect of this release on the environment cannot be predicted, and would depend on the type of failure, size of the tailings impoundment at the time of failure, volume of water associated with the failure, and the initial volume and character of the sediments and the character of concurrent releases from other sources.

Under the worst-case scenario, tailings liquids containing dissolved metals and reagent residues, and large masses of sediment would flush into the Libby Creek stream channel. Some of this sediment mass would probably remain in these stream channels for an undefined period of time following failure, while the liquid and remaining solids would be carried downstream. Subsequent to any such failure, seasonal high flows would continue to wash most of the remaining sediment downstream. Most of the fine sediments from any such catastrophic failure would probably persist in the Libby Creek system for many years.

3.12.4.2.4 Use of Hazardous and Non-Hazardous Chemicals

MMC would use hazardous and non-hazardous materials in its operations, including reagents during milling (potassium amyl xanthate, methyl isobutyl carbinol and polyacrylamide), lubricants, fuel, and blasting agents. Material safety data sheets for the proposed reagents are presented in MMC's Plan of Operations (MMI 2005a, MMC 2008). Some spills or releases of

these materials may occur during transport and use that may result in short-term water quality degradation of area streams. The effect would depend on the response time for cleanup, the toxicity of the material spilled, the size of the spill, how much entered the creek, and how much dilution occurred within the stream. MMC would implement its Emergency Spill Response Plan in the event of any spill or release.

3.12.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would incorporate modifications and mitigating measures proposed by the agencies that would reduce water quality impacts to area streams and springs. The major change from Alternative 2 would be locating the tailings impoundment at the Poorman Tailings Impoundment Site, which would eliminate diversion of Little Cherry Creek. The agencies' analysis assumes that all of the seepage from the Poorman Tailings Impoundment Site would be controlled, such as by pumpback recovery wells, so that none of the water would reach surface water downstream of the impoundment. The total area of disturbance for Alternative 3 would be 2,011 acres.

Based on preliminary design, the Libby Plant Site would not be built with waste rock. If the plant site were not built with waste rock, runoff would be considered stormwater and ELGs would not apply for MPDES permitting. If necessary, any wastewater not used during mining would be pretreated for nitrate prior to discharge to the LAD Areas for secondary treatment. Any wastewater that cannot meet effluent limits would require treatment, either at the Libby Adit Water Treatment Plant or a similar facility, prior to discharge.

About 11,250 gallons per day of sanitary wastewater is estimated to be produced through employee use. This estimate is based on 450 employees and an expected usage rate of 25 gallons of domestic wastewater per day per employee. Sanitary wastewater would be treated, disinfected, and sent to the mill for reuse. If effluent limits could be met, treated sanitary wastewater would be discharged at the LAD Areas during the growing season.

3.12.4.3.1 Effects of Mine Inflows

Water quality impacts to streams, lakes, and springs due to decreases in deep ground water discharges to area surface water would be very similar to Alternative 2. Because the Ramsey Adits would not be constructed, Ramsey Creek and Ramsey Lake would not be affected. Three adits in the Libby Creek drainage may reduce base flow in Libby Creek slightly more than Alternative 2, so water quality effects to Libby Creek may be slightly greater than in Alternative 2. Because deeper ground water is likely to have higher total dissolved solids concentrations (generally greater than 100 mg/L) than shallow ground water or direct runoff to streams (generally less than 50 mg/L), a decrease in the deeper ground water contribution to streamflow may result in lower total dissolved solids concentrations in affected streams. Whether water quality changes in these streams would be measurable or could be separated from natural variability is unknown. Streams, lakes, and springs that may be affected by mine inflows would be extensively monitored by the agencies before construction, during construction and throughout the mining and post-mining periods.

3.12.4.3.2 Effects of Diversions and other Surface Disturbances

It is expected that the small amount of water diverted around the Poorman Tailings Impoundment Site from the small watershed above the impoundment would not measurably affect the water quality of Little Cherry or Libby creeks. The quality of the water would be expected to be very similar to the quality of Little Cherry Creek water. A diversion channel for Little Cherry Creek

would not be constructed, so disturbance associated with such a structure would not occur in Alternative 3. The disturbance area surrounding tailings impoundment would be about 300 acres less than Alternative 2 and the potential for erosion and sedimentation to streams would be less than Alternatives 2 and 4.

The effects of a catastrophic failure of the tailings impoundment would be similar to Alternative 2 (section 3.12.4.2.3, *Effects of Diversions and other Surface Disturbances*). Depending on the nature of the failure, the thickened tailings may result in slightly less sediment delivery to Libby Creek.

In Alternatives 3 and 4, MMC would initially identify existing sediment sources in Libby Creek particularly near the plant site and then off-site in Ramsey, Poorman, or upper Libby creeks. After existing sediment sources were identified, MMC would develop sediment abatement and instream stabilization measures designed to reduce sediment contribution from the identified sources. This mitigation would minimize the contribution of additional sediment to the Libby Creek watershed.

The Wildlife Mitigation Plan in Alternatives 3 and 4 includes 20.3 miles of proposed access changes during the evaluation phase and up to 20.1 miles of proposed access changes prior to mill operations in the Rock Creek, Libby Creek, and Miller Creek watersheds. MMC would build and maintain gates or barriers on the roads, and complete other activities so the roads would either be removed from service, or cause little resource risk if maintenance were not performed on them during the operation period of the mine and prior to their future need. In most cases, culverts would be removed; such removals would occur in active stream channels requiring instream work, structure placement, and fill removal. In the short term, these activities would increase sedimentation in area streams. After the activities were completed, and the roads became stabilized, sediment delivery to area streams would decrease below existing levels.

3.12.4.3.3 Effects of Discharges

Water Quality of Wastewater Sources

As in Alternative 2, discharges of wastewater would occur during construction, operations, and closure phases of the mine. If effluent limits could be met, the LAD Areas and Poorman Tailings Impoundment would receive excess water not used for mine operations during construction, mining, and post-mining. The sources of wastewater would be the same as for Alternative 2 (Table 89) except that:

- The Libby Plant Site would not be a source of mine drainage from waste rock
- Waste rock would be stored temporarily until used for dam construction at a site within the Poorman impoundment uphill from the Starter Dam; the site would be lined if necessary based on the Libby Adit waste stockpile test (section 2.5.3.4, *Waste Rock Management*)

If necessary, all of the mine drainage water proposed for discharge to the LAD Areas would be pretreated. The agencies assumed nitrate removal for the pretreatment system would be 90 percent. The agencies' analysis assumed nitrate concentrations in mine and adit wastewater discharges from the mine and adits following pretreatment would be 2.5 mg/L instead of 25 mg/L used in Alternative 2. Concentrations of all other parameters were assumed to be the same as Alternative 2 (Appendix G).

Because discharges would be small and would occur as increased ground water seepage to stream channels, erosion and sedimentation would not occur. Discharges of stormwater through the overflow pipes from the stormwater retention ponds when storms exceed the pond capacities would flow overland and may increase erosion and stream sedimentation.

Chemical Mass Balance Calculations

Predicted concentrations at RA-600, PM-1200 and LB-1000 with nitrate pretreatment and land application during the construction, mining, and post-mining periods are provided in Table 104 for Alternative 3. Mass balance analyses for other locations in Ramsey, Poorman, and Libby creeks are provided in Appendix G. Effects to springs located close to the LAD Areas, assuming that shallow ground water was a source of supply to such springs, would be similar to that calculated for ground water below the LAD Areas or tailings impoundment.

Table 105 provides a summary of predicted water quality exceedances for Alternative 2 due to wastewater discharge at the LAD Areas. If land application of excess water would result in water quality exceedances, MMC would treat the water at the Libby Adit Water Treatment Plant prior to land application. If needed, an additional water treatment facility may be required. Water discharged from the treatment facilities to a nearby stream could not cause an exceedance in a BHES Order nondegradation limit or water quality standard for all parameters (Table 94). Seepage from the tailings impoundment would have to be captured prior to entering the creek to avoid water quality exceedances in former Little Cherry Creek.

Post-Mining Water Quality

Effects on water quality would be the same as Alternative 2 (section 3.12.4.2.2, *Effects of Discharges*).

3.12.4.3.4 Use of Hazardous and Non-Hazardous Chemicals

The use, management, and fate of hazardous chemicals would be the same as Alternative 2 (section 3.12.4.2.4, *Use of Hazardous and Non-Hazardous Chemicals*).

3.12.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would be similar to Alternative 3, but would have modifications to MMC's proposed Little Cherry Creek Tailings Impoundment as part of the alternative.

3.12.4.4.1 Effects of Mine Inflows

Impacts to streams, lakes, and springs due to decreases in deep ground water discharges to area surface water would be the same as those described in Alternative 3 for the mining and post-mining periods (section 3.12.4.3.1, *Effects of Mine Inflows*).

3.12.4.4.2 Effects of Diversions and other Surface Disturbance

A Little Cherry Creek Diversion Channel would be built and would consist of two main sections: an upper engineered channel and a constructed lower channel to Libby Creek using Channel A proposed in Alternative 2. The engineered channel would be the same as the engineered channel in Alternative 2 and would be designed for the 6-hour Probable Maximum Flood. It would flow into a constructed channel that would be designed to be geomorphologically stable and to handle the 2-year flow event. A floodplain would be constructed along the channel to allow passage of the 100-year flow.

Table 104. Predicted Concentrations with Nitrate Pretreatment and Land Application in Ramsey Creek at RA-600, Poorman Creek at PM-1200, and Libby Creek at LB-1000, Alternative 3.

Parameter	RA-600	PM-1200	LB-1000	Surface Water Standard or BHES Order Nondegradation Limit
During Construction				
Total dissolved solids	<42	<40	<44	100
Ammonia, as N	<0.95	<0.69	<0.36	TIN=1
Nitrate, as N	<0.28	<0.21	0.13	TIN=1
Total inorganic nitrogen	**<1.23**	<0.90	<0.48	TIN=1
Antimony	<0.003	<0.003	<0.004	0.0056
Copper	<0.001	<0.001	<0.001	0.003
Iron	<0.05	<0.05	<0.05	0.1
Manganese	<0.02	<0.02	<0.02	0.05
Zinc	<0.02	<0.02	<0.02	0.025
During Mining				
Total dissolved solids	<40	<38	<46	100
Ammonia, as N	<0.36	<0.47	<0.24	TIN=1
Nitrate, as N	<0.15	<0.16	<0.10	TIN=1
Total inorganic nitrogen	<0.50	<0.63	<0.34	TIN=1
Antimony	<0.003	<0.003	<0.004	0.0056
Copper	<0.001	<0.001	<0.001	0.003
Iron	<0.05	<0.05	<0.05	0.1
Manganese	<0.02	<0.02	<0.02	0.05
Zinc	<0.02	<0.02	<0.02	0.025
During Post-Mining				
Total dissolved solids	<48	<45	<48	100
Ammonia, as N	<0.70	<0.52	<0.27	TIN=1
Nitrate, as N	<0.20	<0.15	0.10	TIN=1
Total inorganic nitrogen	<0.91	<0.67	<0.36	TIN=1
Antimony	<0.004	<0.003	<0.004	0.0056
Copper	<0.002	<0.001	<0.001	0.003
Iron	<0.05	<0.05	<0.05	0.1
Manganese	**<0.11**	**<0.08**	<0.05	0.05
Zinc	<0.02	<0.02	<0.02	0.025

All concentrations are mg/L.
Predicted exceedances without additional treatment beyond nitrate pretreatment and land application of BHES Order limits or surface water standards are shown in **bold**.
TIN=total inorganic nitrogen.

Table 105. Water Quality Parameters that May Exceed Standards or BHES Order Nondegradation Limits due to Wastewater Discharge at the LAD Areas, Alternative 3.

Stream Monitoring Site	Construction	Mining	Post-Mining
RA-400	none	none	manganese
RA-600	TIN	none	manganese
PM-1000	none	none	none
PM-1200	none	none	manganese
LB-300	none	none	none
LB-800	none	none	none
LB-1000	none	none	none
LB-2000	none	none	none

Monitoring sites are shown in Figure 76.
Predicted exceedances based on no additional treatment beyond nitrate pretreatment and land application.
TIN=total inorganic nitrogen.

Substantial erosion and sedimentation should not occur because the new channel would be constructed prior to diverting Little Cherry Creek. The majority of sediment generated would occur during initial channel flush and subsequent high flow and runoff events. In the event of heavy precipitation during construction of the channel, substantial erosion and short-term increases in sedimentation to the lower channel and Libby Creek may occur. Natural and biodegradable materials and vegetation would be used along stream banks and on the floodplain to minimize erosion, stabilize the stream channel and floodplain, and minimize sedimentation to the lower channel and Libby Creek. MMC would construct bioengineered and structural features in the two channels to reduce flow velocities, and minimize erosion and sedimentation, where access were possible to complete such work. Long-term monitoring and maintenance would be required, if necessary, until the agencies determine that the channel was stabilized. Even with these mitigation measures, the constructed natural-designed channel would be subject to erosion and sedimentation during construction and until vegetation stabilizes the stream banks and floodplain.

Following reclamation of the impoundment, the constructed channel would undergo an additional period of channel adjustment when runoff from the impoundment surface was directed to the Diversion Channel. The increase in flow would be about 50 percent higher than during operations, and would lead to new channel adjustments. This would likely cause short-term increases in sedimentation in the lower channel and possibly Libby Creek.

The effects of a catastrophic failure of the tailings impoundment would be the same as Alternative 2 (section 3.12.4.2.3, *Effects of Diversions and other Surface Disturbances*).

The effects of proposed fisheries and wildlife mitigation would be the same as Alternative 3 (section 3.12.4.3.2, *Effects of Diversions and other Surface Disturbances*).

3.12.4.4.3 Effects of Discharges

As in Alternative 2, discharges of wastewater would occur during construction, operations, and closure phases of the mine. The sources and quality of water would be the same as for Alternative 2. Predicted concentrations in area streams are nearly identical to those shown for Alternative 3 in Table 104 and Table 105. If necessary, MMC would treat the water at the Libby Adit Water

Treatment Plant prior to land application. If needed, an additional water treatment facility may be required. Seepage from the tailings impoundment would be captured prior to reaching surface water.

Post-Mining Water Quality

Effects on water quality would be the same as Alternative 2 (section 3.12.4.2.2, *Effects of Discharges*).

3.12.4.4.4 Use of Hazardous Chemicals

The use, management, and fate of hazardous chemicals would be the same as Alternative 2 (section 3.12.4.2.4, *Use of Hazardous and Non-Hazardous Chemicals*).

3.12.4.5 Alternative A – No Transmission Line

In Alternative A, the transmission line and substation for the Montanore Project would not be built. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Possible impacts to streams due to construction, operation, and maintenance of a new transmission line would not occur.

3.12.4.6 Alternative B – MMC Proposed Transmission Line (North Miller Creek Alternative)

The Ramsey Plant Site's electrical service would be provided via a new, overhead transmission line. MMC's proposed alignment would be in the Fisher River, Miller Creek, Midas Creek, Libby Creek, and Ramsey Creek watersheds. This alternative would create the greatest amount of disturbance close to streams because it would have the highest new road mileage and disturbed acreage in areas with severe erosion risk, high sediment delivery to nearby streams and greatest slope failure potential (see Table 134 in section 3.18, *Soils and Reclamation*). Possible sediment sources would include new road construction, existing road upgrades, timber and vegetation clearing, soil stripping, and structure installation. The highest risk of increased sediment would occur during the construction phase of the transmission line, when trees, vegetation, and soils were removed from the transmission line corridor, substation site, and access roads.

Occasional short-term increases in the amount of sediment in analysis area streams would be likely within all watersheds. Alternative B would have the greatest effect within the watersheds of 303(d)-listed streams (Table 106) and Class 1 streams (Table 107). Alternative B would parallel about 4.7 miles of line in the Fisher River, where soils with severe erosion risk and high sediment delivery are found. Two structures and a new road would be required immediately adjacent to the river near the Fisher River crossing. Clearing for the transmission line would disturb about 83.5 acres in the watershed, and new or upgraded roads would disturb 1.9 acres (Table 106). Alternative B line clearing also would disturb 11.2 acres and 1.6 acres by new or upgraded roads in the Libby Creek drainage. The soils at the Libby Creek crossing have severe erosion risk and high sediment delivery. These two stream segments are 303(d)-listed streams. Use of BMPs, Environmental Specifications, and other design criteria would minimize sediment increases in analysis area streams under most conditions.

Table 106. Transmission Line Disturbances in the Watersheds of 303(d)-Listed Streams.

Criteria	Alternative B–North Miller Creek (ac.)	Alternative C–Modified North Miller Creek (ac.)	Alternative D–Miller Creek (ac.)	Alternative E–West Fisher Creek (ac.)
Fisher River Watershed				
Clearing area†	83.5	58.3	58.3	19.6
New roads + closed roads with high upgrade requirements	1.9	0.3	0.3	0.0
Libby Creek Watershed				
Clearing area†	11.2	9.2	9.5	9.5
New roads + closed roads with high upgrade requirements	1.6	0.3	0.3	0.3

†Acreage is based on a 150-foot clearing width for monopoles (Alternative B) and 200-foot width for H-frame structures (other alternatives except for a short segment of the West Fisher Creek Alternative E that has monopoles). Actual acreage cleared would be less than listed and would depend on tree height, slope, and line clearance above the ground.
Source: GIS analysis by ERO Resources Corp. using DEQ data.

Table 107. Transmission Line Disturbances in the Watersheds of Class 1 Streams.

Feature	Alternative B–North Miller Creek (ac.)	Alternative C–Modified North Miller Creek (ac.)	Alternative D–Miller Creek (ac.)	Alternative E–West Fisher Creek (ac.)
New/High Upgrade Roads	7	<1	<1	<1
Vegetation Clearing (other than for roads)	107	72	47	47

No Class 2 streams are in the transmission line analysis area.
Source: GIS analysis by ERO Resources Corp. using FWP data.

MMC would develop and implement a construction Stormwater Pollution Prevention Plan (SWPPP) to minimize the discharge of pollutants to streams during construction. The SWPPP requires the plan to be designed for a 10-year/24-hour storm event (2.4 inches). If a larger storm occurred during the construction or reclamation period, erosion and runoff measures in the plan may not be adequate to prevent sediment from entering area streams. Pollutants may include sediment in runoff from construction sites, deposition directly into stream channels or airborne movement of dust into streams. Structural and non-structural BMPs (Appendix D) would be implemented to minimize stream pollution. After construction was completed, disturbed areas would be stabilized and revegetated. Erosion and sediment increases would decrease after vegetative cover was re-established. The DEQ would require on-site inspections of stream crossings to determine the method that would result in minimizing impacts to stream banks and water quality considering the nature and cost of the available crossing methods.

3.12.4.7 Alternative C – North Miller Creek Transmission Line Alternative

The primary modification to MMC's proposed North Miller Creek Alternative would be routing the line on an east-facing ridge immediately north of the Sedlak Park Substation. This modification would partially address issues associated with water quality by crossing less area with soils that are highly erosive and subject to high sediment delivery and slope failure (see Table 134 in section 3.18, *Soils and Reclamation*) and locating the line farther from streams and wetlands. Other modifications to the alignment are relatively small shifts along Miller Creek and an unnamed tributary to Miller Creek that would move the line farther from these streams and reduce the likelihood of sediment entering the streams. H-frame structures, which generally allow for longer spans and fewer structures and access roads, would be used on this alternative. In some locations, a helicopter would be used to place the structures. These two modifications would reduce potential impacts to water quality by reducing clearing and disturbance associated with new access roads. For analysis purposes, Alternative C would end at the Libby Plant Site proposed in Alternatives 3 and 4. Effects would be slightly greater than discussed below if this alternative were selected with Alternative 2.

New road mileage and disturbed acreage would be less in Alternative C than Alternative B (Table 33 in Chapter 2; Table 134). Occasional sediment increases would likely still occur within the streams, but the frequency and magnitude of these increases would be substantially less than in Alternative B.

Alternative C would have fewer disturbances in the watersheds of 303(d)-listed streams than Alternative B (Table 106). Clearing for the transmission line would disturb 58 acres in the Fisher River watershed and 9 acres in the Libby Creek watershed. New or upgraded roads would disturb 0.3 acre in both watersheds.

In Alternatives C, D, and E, installation of culverts, bridges, or other structures at stream crossings would be specified by the agencies following on-site inspections with DEQ, FS, FWP, and local conservation districts. Installation of culverts or other structures in a water of the United States would be in accordance with the U.S. Army Corps of Engineers 404 and DEQ 318 permit conditions. All culverts would be sized according to Revised Hydraulic Guide KNF (1990) and amendments. Where new culverts were installed, they would be installed so water velocities or positioning of culverts would not impair fish passage. Stream crossing structures would be able to pass the 100-year flow event.

In Alternatives C, D, and E, MMC would initially identify existing sediment sources in Libby Creek particularly near the plant site and then off-site in Ramsey, Poorman, or upper Libby creeks. After existing sediment sources were identified, MMC would develop sediment abatement and instream stabilization measures designed to reduce sediment contribution from the identified sources. This mitigation would reduce the contribution of additional sediment to below existing levels in the Libby Creek watershed. Other effects of Alternative C would be the same as Alternative B (section 3.12.4.6, *Alternative B – MMC Proposed Transmission Line (North Miller Creek Alternative)*).

3.12.4.8 Alternative D – Miller Creek Transmission Line Alternative

Like the Modified North Miller Creek Alternative, this alternative modifies MMC's proposed North Miller Creek Alignment by routing the line on an east-facing ridge immediately north of the Sedlak Park Substation. East of the Fisher River, this alignment would cross less area with

soils that are highly erosive and subject to high sediment delivery and slope failure, reducing the potential for increased sediments in nearby streams (Table 134). Other modifications to the alignment are relatively small shifts along Miller Creek. H-frame structures, which generally allow for longer spans and fewer structures and access roads, would be used on this alternative. These two modifications would reduce potential impacts to water quality by reducing clearing associated with new access roads. For analysis purposes, Alternative C would end at the Libby Plant Site proposed in Alternatives 3 and 4. Effects would be slightly greater than discussed below if this alternative were selected with Alternative 2.

New road mileage and disturbed acreage would be less in Alternative D than Alternative B, but would be greater than Alternative C (Table 134). Occasional sediment increases would likely still occur within the streams, but the frequency and magnitude of these increases would be substantially less than in Alternative B. Effects of Alternative D in the watersheds of 303(d)-listed streams would be similar to Alternative C (Table 106). The agencies' mitigation would reduce the contribution of additional sediment to below existing levels in the Libby Creek watershed. Other effects of Alternative D would be the same as Alternative B (section 3.12.4.6, *Alternative B – MMC Proposed Transmission Line (North Miller Creek Alternative)*).

3.12.4.9 Alternative E – West Fisher Creek Transmission Line Alternative

This alternative alignment would end at the Alternative 3 Libby Plant Site. Like the Modified North Miller Creek Alternative, this alternative modifies the North Miller Creek Alternative by routing the line on an east-facing ridge immediately north of the Sedlak Park Substation. This route would cross and slope failure, reducing the potential for increased sediments in nearby streams. H-frame structures, which generally allow for longer spans and fewer structures and access roads, would be used on this alternative in most locations. In some locations, a helicopter would be used to place the structures. These two modifications would reduce potential impacts to water quality by reducing clearing associated with new access roads. For analysis purposes, Alternative E would end at the Libby Plant Site proposed in Alternatives C and D. Effects would be slightly greater than discussed below if this alternative were selected with Alternative B.

New road mileage and disturbed acreage would be less in Alternative E than Alternative B (Table 134). Occasional sediment increases would likely still occur within the streams, but the frequency and magnitude of these increases would be substantially less than in Alternative B. Alternative E would have the least total disturbance in 303(d)-listed watersheds, disturbing 19.6 acres of line clearing in the Fisher River watershed, and 9.5 acres of line clearing and 0.3 acre for new or upgraded roads in the Libby Creek watershed (Table 106). The agencies' mitigation would reduce the contribution of additional sediment to below existing levels in the Libby Creek watershed. Other effects of Alternative E would be the same as Alternative B (section 3.12.4.6, *Alternative B – MMC Proposed Transmission Line (North Miller Creek Alternative)*).

3.12.4.10 Cumulative Effects

Past and current actions, particularly timber harvest, road construction, and mining, have altered surface water quality in the area by increasing sedimentation, destabilizing stream channels and removing streamside vegetation. The DEQ's 303(d) listing indicates Libby Creek is impaired because of alteration in stream-side or littoral vegetative covers, mercury exceedances, and physical substrate habitat alterations likely resulting from impacts from abandoned mine lands and placer mining. Past activities also have impaired water quality in segments of the Fisher

River and Rock Creek. Current actions, such as the Snowshoe Mine and Snowshoe Creek CERCLA Project, are designed to reduce effects of past mining activities.

Suction dredging activities are currently permitted in the Libby Creek drainage. These mining activities may alter surface water quality in the area by increasing sedimentation and destabilizing stream channels. Lifting and sorting of streambeds can also mobilize elements, such as mercury and other metals. Monitoring by the KNF indicates limited sediment increases in the stream below dredging operations. At low flows, pools tend to accumulate sediment transported as bedload. Deposition of bedload would be more pronounced near the dredging sites. Unless substantial bank erosion occurs, increased sediment transport is limited because the overall sediment load delivered to the channel remains the same, and the effects downstream are probably minor (KNF 2007c). Other human activities that may impair surface water quality include septic field installation, livestock grazing, new roads, and other construction. Stream channel and bank stabilization or restoration projects may improve stream water quality.

The Miller-West Fisher Vegetation Management Project consists of commercial timber harvest, precommercial thinning and prescribed fire; access management changes; trail construction and improvement; treatment of fuels in campgrounds; and watershed rehabilitation activities in the Miller, Silver Butte, and West Fisher Creek watersheds. If timber harvest activities occurred during the transmission line construction, the two projects would cumulatively increase sediment in Miller Creek or West Fisher Creek, depending on the transmission line alignment. Road and access management, and watershed condition improvements proposed in the Miller-West Fisher Vegetation Management Project would minimize adverse cumulative effects on surface water quality.

3.12.4.11 Regulatory/Forest Plan Consistency

All mine and transmission line alternatives would be in compliance with the KFP and the Montana Water Quality Act because alternatives would implement and maintain recommended BMPs and would comply with DEQ permitting requirements and water quality standards.

3.12.4.12 Irreversible and Irretrievable Commitments

Because discharges would be required to meet BHES Order nondegradation limits or water quality standards, the effects of the discharges to surface water quality would not be an irretrievable or irreversible commitment of surface water resources.

Water quality impacts resulting from mine inflows during and post-mining, if measurable, would be permanent and are both irreversible and irretrievable commitments of surface water resources. Under all alternatives, water quality impacts to springs located under the alternative tailings impoundment sites would be an irreversible and irretrievable commitment of surface water resources.

3.12.4.13 Short-Term Uses and Long-Term Productivity

Any change in stream water quality due to discharging mine water to area streams would be a short-term use of the resource. Changes that may occur that would affect the long-term productivity of surface water resources in terms of water quality include:

- Water quality changes that may occur due to loss of deep ground water supply to streams, springs, and lakes
- Water quality changes to streams that would occur in Alternative 2 or 4 due to the diversion of Little Cherry Creek flows into other channels

3.12.4.14 Unavoidable Adverse Environmental Effects

Sediment loading to the analysis area streams would increase due to erosion from mine facility and transmission line construction.

3.13 Water Rights

3.13.1 Regulatory Framework

The Montana Water Use Act requires that any person, agency, or governmental entity intending to acquire new or additional water rights or change an existing water right in the state obtain a beneficial water use permit before commencing to construct new or additional diversion, withdrawal, impoundment, or distribution works for appropriation of ground water over 35 gpm or 10 acre-feet per year for any surface water. The Montana Water Rights Bureau, within the Water Resources Division of the DNRC, administers the Water Use Act and assists the Water Court with the adjudication of water rights.

An Application for Beneficial Water Use Permit requires proof that there is water physically and legally available at the proposed point of diversion in the amount requested (DNRC 2008). If senior water users would be adversely affected by a new use, the application must include specific conditions that the new water user is willing to accept to eliminate or mitigate potential adverse effects to senior water rights holders. For example, a new water user may need to divert or pump water only at certain times when adequate water is available for all users or may need to find water from another source to replace water taken by the new user.

Additional requirements for obtaining a new water rights permit come from the Forest Service/State of Montana Reserved Water Rights Compact (85-20-1401, MCA):

- A federal authorization is required to occupy, use, or traverse National Forest System lands for the purpose of diversion, impoundment, storage, transportation, withdrawal, use, or distribution of water for the appropriation or change of appropriation
- When a state permit is required prior to a new appropriation of water, including ground water, or a change of appropriation, the applicant is required to show proof of federal authorization before the application for a new appropriation of water or a change of appropriation will be considered correct and complete
- A state permit for a new appropriation will be subject to any terms, conditions, and limitations related to the use of water contained in the required federal authorization

3.13.2 Analysis Area and Methods

The analysis area includes the area where surface water rights may be affected by mine operations. Construction and maintenance of the transmission line would not affect surface water rights. This area includes the Ramsey Creek, Poorman Creek, Bear Creek, Libby Creek, East Fork Rock Creek, and East Fork Bull River watersheds (Figure 76). Water rights in streams in the transmission line corridors would not be affected. The impact to water rights from pumping from the make-up wells were estimated using a Theis drawdown analysis, which assumes homogeneous ground water conditions (ERO Resources Corp. 2008a). Possible impacts to surface water rights due to changes in streamflow were evaluated quantitatively by comparing pumping rates to estimated average and $7Q_{10}$ streamflows.

3.13.3 Affected Environment

Surface water in the analysis area is used for a variety of beneficial uses including domestic water supply, irrigation, mining, stock watering, fish habitat, and wildlife. The DNRC has 64 water rights on record for surface water within the Libby Creek watershed, including the use of springs and diversions along Bear, Little Cherry, Poorman, Ramsey and Libby creeks. Of these 64 rights, 19 are in the analysis area. Most of the recorded surface water permits are for domestic, irrigation, and mining or industrial use. MMC holds three water rights for mining, two for surface water (with a total diversion right for 59.9 gpm), and one for ground water (40 gpm). All but two of the 277 ground water rights are downstream of the analysis area. No surface water rights are on the East Fork Bull River and no ground water rights in the East Fork Bull River basin. One domestic surface water right for 10 gpm and a shallow ground water right for 20 gpm are held on Rock Creek about 2 miles downstream of the confluence of West Fork Rock Creek and East Fork Rock Creek.

3.13.4 Environmental Consequences

3.13.4.1 Alternative 1 – No Mine

In this alternative, MMC would not develop the Montanore Project. Any existing exploration-related or baseline collection disturbances by MMC would be reclaimed in accordance with existing laws and permits. Surface and ground water rights in the area would not be affected. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands.

3.13.4.2 Alternative 2 – MMC Proposed Mine

For all of the action alternatives, MMC would need to acquire a new ground water appropriation from the DNRC to use adit and mine inflows for mining purposes. MMC anticipates inflows to be between 600 and 800 gpm on a steady-state basis, with short-term inflows of up to 1,200 gpm.

Additional water rights for make-up water beyond the 99.9 gpm that MMC currently holds would be needed if inflows were less than about 1,000 gpm. MMC anticipates needing 144 gpm of water if mine inflows were 800 gpm and 494 gpm if mine inflows were 450 gpm. Although MMC did not specify where make-up water would be procured, it is likely that pumping from any well field would reduce flows within Libby Creek. Three Libby Creek surface water rights for mining located in Section 18, Township 28 North, Range 30 West within 1 mile of the northeast permit area boundary, downstream of the confluence of Bear Creek and Libby Creek (76D-76911-00, 76D-30480-00, and 76D-64963-00) with total rights for 800 gpm (1.8 cfs) of surface water flow in Libby Creek, would not be affected by the flow reductions even during very low flows. If mine inflows were 450 gpm, then the make-up well requirement would be about 15 percent of the estimated $7Q_{10}$ flow of Libby Creek at LB-2000. If mine inflows were 800 gpm, the make-up well requirement would be about 4 percent of the $7Q_{10}$ flow of Libby Creek at LB-800. Even during a 15 percent flow reduction, more than adequate flow in Libby Creek would be available to supply the needs of the existing water rights.

Pumping of the make-up wells would likely decrease ground water levels. A reduction in the water level elevation would not affect a spring water right for mining (76D-28349-00) for 15 gpm

located west of Libby Creek and north of Bear Creek (Section 18, Township 28 North, Range 30 West) because all of the water would be withdrawn from the Libby Creek alluvium. Before a new appropriation would be permitted by the DNRC, MMC would need to prove the physical and legal availability of the water needed at the chosen location and would need to include specific conditions that they would be willing to accept to eliminate or mitigate any potential adverse effect to senior water right holders.

Under this alternative, streamflow increases that would occur during discharges of wastewater would not adversely affect area surface or ground water rights. Reductions in streamflows and the ground water table as a result of mine inflows may affect nearby surface and ground water rights within the modeled radius of influence (see section 3.10.4.2.1, *Mine Area* for further discussion). At the locations of the existing water rights, it may be difficult to measure the effect or to separate the effect from natural streamflow variability and ground water levels.

3.13.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Under this alternative, effects to area surface and ground water rights due to mine inflows and mine discharges would be very similar to Alternative 2 (section 3.13.4.2, *Alternative 2 – MMC Proposed Mine*). If necessary, one or more bulkheads would be installed in the mine to minimize post-mining effects to the East Fork Bull River and East Fork Rock Creek streamflow. Because more water would be available for mill use by thickening the tailings, less make-up water would be needed in Alternative 3. Pumping from the make-up wells would not affect existing water uses.

3.13.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

The effects to area surface and ground water rights would be the same as described in Alternative 3 above.

3.13.4.5 Transmission Line Alternatives

Alternative A would not affect any water rights. The small flow changes expected to occur as a result of land clearing, dust control or concrete mixing for the transmission line alternatives are not expected to adversely affect area water rights users.

3.13.4.6 Cumulative Effects

Cumulative effects in the analysis area that could affect surface and ground water rights have been discussed in sections 3.10.4.5 and 3.11.4.10, *Cumulative Effects*. Activities could either increase or decrease water sources to streams, springs, lakes, and ground water aquifers and may affect the water supply for existing water rights if streamflows or ground water levels are reduced more than occurs due to natural variability. Modeling of the cumulative effects of mine inflows to both the Montanore and Rock Creek mines shows an increased area of ground water drawdown west of the mountain divide; a shallow ground water right on Rock Creek may be affected by the cumulative streamflow reduction that would occur in Rock Creek.

3.13.4.7 Regulatory/Forest Plan Consistency

With acquisition of water rights for mine inflows and any make-up water, all action alternatives would comply with the Montana Water Use Act and the KFP.

3.13.4.8 Irreversible and Irretrievable Commitments

This section is not applicable to water rights.

3.13.4.9 Short-Term Uses and Long-Term Productivity

This section is not applicable to water rights.

3.13.4.10 Unavoidable Adverse Environmental Effects

The issuance of a new water right would not adversely affect other water right holders.

3.14 Land Use

3.14.1 Regulatory Framework

3.14.1.1 Kootenai Forest Plan

The KFP guides all natural resource management activities and establishes management standards for the KNF (USDA Forest Service 1987). The KFP establishes management direction in the form of prescriptions consisting of goals, objectives, standards, and guidelines. This direction may be established to apply throughout the forest plan area (forest-wide direction), or it may be established for only a part of the forest plan area, a Management Area (MA). The Montanore Project is being evaluated under the 1987 KFP. The KNF is undergoing a forest plan revision in cooperation with the Idaho Panhandle National Forest. The revision is not completed and the direction provided by the 1987 KFP is applicable to the Montanore Project. Management direction for the land use analysis area is described in section 3.14.3.2, *Kootenai National Forest Land Management Plan* below.

3.14.1.2 Montana Fish, Wildlife, and Parks/Plum Creek Conservation Easement

The FWP holds a conservation easement on some lands owned by Plum Creek where the transmission line may be located. Under the terms of the conservation easement, the FWP has reserved the right to prevent any inconsistent activity on or use of the land by Plum Creek or other owners and to require the restoration of any areas or features of the land damaged by such activity or use. Activities and uses prohibited or restricted include installing any natural gas or other pipelines or power transmission lines greater than 25-kV unless the prior written approval is given by the FWP.

3.14.1.3 Local Plans

Unincorporated Lincoln County has no comprehensive or general plan, zoning regulations, or growth policies.

3.14.2 Analysis Area and Methods

3.14.2.1 Analysis Area

The analysis area for land use encompasses an area potentially affected by project facilities: along the Bear Creek Road south from U.S. 2, the proposed permit boundary areas for the mining facilities, and the area crossed by the four transmission line alternatives and associated access roads (Figure 77). MMC's mine permit application (MMI 2005a) contained information about land use in the mine area. In 2005, MMC completed a land use inventory for the transmission line corridors that MMC analyzed by reviewing, refining, and updating existing data (Power Engineers 2005c). The KNF provided digital data on the distribution of MAs on National Forest System lands. The KFP provided management prescriptions for each MA by resource, including recreation, wildlife and fish, timber, soils, water, and air resources, minerals and geology, lands, and facilities (USDA Forest Service 1987).

3.14.2.2 Methods

The effects analysis assessed how the transmission line and mine facilities may alter existing land uses on both private and public lands within the land use analysis area. The changes in land use in the mine area were calculated based on the acreage of each permit area, and a 100-foot wide road corridor along the Bear Creek Road (NFS road #278), which is outside of a permit area.

In the 1993 ROD approving the lead agencies' preferred alternative for Noranda's proposed Montanore Project, the KNF amended the KFP and reallocated an area surrounding the Little Cherry Creek Impoundment Site and the Ramsey Plant Site to MA 31. MA 31 is designed to accommodate the activities associated with mineral development on the KNF (USDA Forest Service 1993). Because of improved mapping capabilities between 1993 and 2007 and a slight change in impoundment design from that approved in 1993, all areas currently proposed for disturbance at the Ramsey Plant Site and the Little Cherry Creek Impoundment Site were not previously reallocated to MA 31. In Alternatives 2, 3 and 4, the KNF would amend the KFP by reallocating to MA 31 all areas within the permit areas of the plant site, the tailings impoundment, and LAD Areas 1 and 2 that currently are not MA 31. In addition, a proposed road and facility corridor that would cross MA 13 would need to be reallocated to MA 31. This amendment would apply only to National Forest System lands disturbed by any mine alternative, and would not apply to private lands affected by the mine alternatives. Maps showing areas of proposed reallocation are available at the KNF. Changes to existing MA designations were calculated for project facilities in each of the alternatives.

The changes in land use in the transmission line corridors were calculated based on the acreage within a 150-foot tree clearing width for monopoles (Alternative B) and a 200-foot width for H-frame structures (for other alternatives except for a short segment of the West Fisher Creek Alternative that has monopoles). Actual acreage cleared would be less and would depend on tree height, slope, and line clearance above the ground. Acreage of new roads and roads with extensive upgrading requirements was based on an assumed total disturbance width of 25 feet. Miles of different management areas crossed by each alternative also were calculated.

Similar to the mine area, the KNF amended the KFP in the 1993 ROD and reallocated areas crossed by the selected North Miller Creek transmission line classified as "corridor avoidance" areas (224 acres) to MA 23. MA 23 is designed to accommodate the activities associated with electrical transmission corridors on the KNF (USDA Forest Service 1987). Because of improved mapping capabilities between 1993 and 2007 and changes in the transmission line alignment from that approved in 1993, all areas currently proposed for disturbance by MMC's proposed transmission line alignment classified as corridor avoidance areas were not reallocated to MA 23.

In transmission line Alternatives B, C, D, and E, the KNF would amend the KFP by reallocating certain areas within a 500-foot corridor of the selected 230-kV transmission line on National Forest System lands as MA 23. A corridor wider than that used in 1993 was used because the final transmission line alignment may be within 250 feet of the centerline analyzed in the EIS and within 250 feet of the approved facility location (centerline) (ARM 17.20.301 (21)). Specifically, the amendment would apply to the following MAs if crossed by the transmission line: MA 10 and 11 if the proposed corridor were within grizzly bear management situation 1 or 2; and MAs 2, 6, 12, 13, and 14. This amendment would apply only to certain National Forest System lands that currently are not MA 23 disturbed by any transmission line alternative, and would not apply to

private lands crossed by the transmission line alternatives. Maps showing areas of proposed reallocation are available at the KNF.

3.14.3 Affected Environment

The KNF manages most lands in the land use analysis area (Figure 77). Private land occurs along Libby Creek, Little Cherry Creek, Miller Creek, West Fisher Creek, and Fisher River. Mine facilities associated with the Montanore Project would be developed on patented mining claims and on unpatented mining claims on National Forest System lands under KNF's management. The KNF manages public land for multiple use benefits, including wood products, recreation, range, wildlife, mineral development, and wilderness. Forest industry land is primarily managed for wood products, and private lands are managed to satisfy individual landowner objectives. Plum Creek owns most of private lands in the land use analysis area (Figure 77).

The National Forest System lands of the Libby Ranger District provide about 6 to 8 million board feet (mmbf) of timber annually. No KNF timber sales are currently under contract in the land use analysis area as of May 2008. As discussed in section 3.3, *Reasonably Foreseeable Future Actions*, the KNF is currently considering the Miller-West Fisher Vegetation Management Project in the land use analysis area. Timber harvest activity also occurs on private, forest-industry lands. The amount of timber harvested has declined in the past 10 years. Small-scale timber harvests occur in the range of 2 to 6 mmbf annually on the private lands in the land use analysis area (Edwards, pers. comm. 2005). Plum Creek has harvested several tracts of private, forest-industry lands on lower Miller Creek and along the Fisher River.

One parcel of state land is crossed by the West Fisher Creek alignment. The DNRC manages the surface and mineral resources for the benefit of the common schools and six administrative land offices, under the direction of the State Board of Land Commissioners. The DNRC's obligation for management and administration of Trust Land is to obtain the greatest benefit for the beneficiaries. The greatest monetary return must be weighed against the long-term productivity of the land to ensure continued future returns to the trusts. The Northwestern Land Office of the DNRC facilitates local management of the state lands within the land use analysis area. Hunting also occurs on state land (Power Engineers 2005c).

Some mineral activity currently occurs in the land use analysis area, including small placer operations on Libby and Big Cherry creeks, and small lode mining operations along Libby Creek. A number of mineral operators do some form of mine development work along the east face of the Cabinet Mountains each year. The DEQ permitted three small sand and gravel operations within the land use analysis area.

One electrical transmission line is located in the land use analysis area. The BPA currently operates the Noxon-Libby 230-kV transmission line near the proposed Sedlak Park Substation. No pipelines 8 inches or greater in diameter occur within 1 mile of the transmission line alternatives.

Four Montana Department of Agriculture registered general (commercial) apiaries are located in the land use analysis area. Commercial apiaries are used for honey production and/or pollination. General (commercial) apiary registrations are apiaries placed by permission on someone's property and contain more than five hives.

3.14.3.1 Private Lands

Southern Lincoln County is a rural area with no major population centers. Large-lot residential properties, ranches, and cabins are found along U.S. 2 near Libby Creek Road (NFS road # 231), Bear Creek Road (NFS road # 278), the Fisher River, Pleasant Valley, and Schrieber Lake. The City of Libby is along the Kootenai River about 15 miles north of the land use analysis area. Fourteen residences are within 1 mile of the four transmission line alternatives. Most of these properties are within 0.5 mile of U.S. 2 (Figure 78). No platted subdivisions are within 1 mile of the transmission line alternatives. The Libby Adit Site and portions of the Little Cherry Creek Impoundment Site are private lands owned by MMC.

In 2003, Plum Creek initiated a transaction to sell a conservation easement to the FWP on 142,000 acres in northwest Montana, some of it within the land use analysis area (Figure 77). The land covered by the conservation easement offers opportunities for the continuation of forest and resource management, commercial timber harvesting and other commodity use, recreational characteristics, and open space, all of which provide fish and wildlife habitat. The conservation easement was mapped and reviewed during the transmission line screening analysis process (ERO Resources Corp. 2006b).

Plum Creek lands not covered by the conservation easement are currently managed the same as easement lands (*i.e.*, timber harvest and other commodity use, recreation, and wildlife habitat). Because these lands are not subject to the conservation easement, future land uses by Plum Creek or subsequent owners could change to include activities prohibited by the easement (Parker 2008).

3.14.3.2 Kootenai National Forest Land Management Plan

Land management direction for the KNF is described in the following sections. Management prescriptions are specified for each MA by resource, including recreation, wildlife and fish, timber, soils, water, and air resources, minerals and geology, lands, and facilities.

3.14.3.2.1 Forest-wide Goals, Objectives, and Standards

Goals

Goals provide information on the long-range management intent. The objectives and standards of both the forest as a whole and individual MAs must support the goals. All activities conducted on the KNF must contribute to the realization of the goals (KFP Vol. 1 II-1). The goal for mineral development, discussed under Goal #11 is to "encourage responsible development of mineral resources in a manner that recognizes national and local needs and provides for economically and environmentally sound exploration, extraction, and reclamation." (KFP Vol. 1 II-2). The KFP also establishes a goal of providing a sustained yield of timber volume responsive to market demands and supportive of a stable base of economic growth in the dependent geographic area (KFP Vol. 1 II-1 #1).

Goals for wildlife resources include: (1) maintaining and enhancing sufficient habitat to facilitate recovery of threatened and endangered species (KFP Vol. 1 II-1 #6); (2) maintaining diverse age classes of vegetation to support viable populations of existing vertebrate species, including old growth dependent species (KFP Vol. 1 II-1 #7); (3) managing for sufficient snags (dead standing trees) to maintain viable populations of snag-dependent species (KFP Vol. 1 II-1 #8); and (4) maintaining big game and fisheries habitat (KFP Vol. 1 II-2 #12, #13).

For water quality, the KFP establishes a goal of meeting or exceeding state water quality standards (KFP Vol. 1 II-1 #19). To achieve this goal, forest-wide objectives for water quality require application of practicable mitigation measures, including those identified in the Soil and Water Conservation Handbook (USDA Forest Service 1988b).

Objectives

Mineral exploration and development may occur on nearly all areas of the KNF; areas withdrawn from future mineral entry include the CMW and developed recreation sites. MMC currently holds mineral rights inside the CMW established prior to the legislatively mandated withdrawal date. The objective concerning minerals requires consideration of other resources during mineral exploration and development (KFP Vol. 1 II-8).

Objectives for facility corridors, such as a transmission line, are discussed under Corridors in the KFP. The objectives establish corridor exclusion, avoidance, and window areas to assist in corridor siting (KFP Vol. 1 II-11). Criteria for these areas are outlined in Appendix 15, Corridor Criteria, of the KFP. Goals and objectives for cultural resources, recreation, visual resources, air quality, road management, and riparian areas have also been established and are described in the KFP (KFP Vol. 1 II-5, II-6, II-10, II-11). These are described in other sections of this chapter.

Standards

The minerals standard requires the KNF to "recognize the value and importance of the mineral resource in management activities" (KFP Vol. 1 II-27). Road access for mineral development "will be allowed if it is the next logical step in the development of the mineral resource," subject to the restriction of various laws, such as the Wilderness Act and the Endangered Species Act. Plans of Operations for mineral development must include "reasonable and justified" requirements designed to minimize environmental impacts (KFP Vol. 1 II-27). Under the minerals standard, the KNF will provide guidance to the mineral industry, where possible, to assist in developing mining plans that minimize environmental damage (KFP Vol. 1 II-27).

3.14.3.2.2 Management Area Goals and Standards

The KFP describes the goals and standards for 24 MAs located on the forest. The MAs within or adjacent to the land use analysis area are described in the following sections (maps of these management areas are available from KNF). The standards are summarized in Table 108. MAs classified as corridor exclusion or corridor avoidance areas are shown on Figure 78.

For all MAs discussed in the following sections, the standard for minerals refers to the forest-wide standards described in the above section. In all MAs, soil and water conservation practices are to be implemented for all developmental activities.

Semi-primitive Non-motorized Recreation (MA 2). The goal of MA 2 is to provide the protection and enhancement areas for roadless recreation use and to provide for wildlife management where specific wildlife values are high. In some areas, this MA provides habitat that will contribute to grizzly bear recovery. Some roads are currently open to some form of motorized recreational use, including snowmobiles. Roads may be justified for mineral activities. This MA is classified as a corridor avoidance area (KFP Vol. 1 III-5).

Table 108. Summary of Relevant Standards in Selected Management Areas on the KNF.

Management Area	Locatable Mineral Development	Powerline Corridors	Lands and Facility Occupancy	Motorized Access	Wildlife	Logging	Visual Quality Objective	Road Development
Semi-primitive non-motorized recreation (MA 2)	Forest-wide standards apply	Avoidance area	Frequently used facilities normally prohibited	Closed, except for limited exceptions	Grizzly habitat	Unsuitable	Retention	Generally prohibited; existing roads may be used for mineral development on a case-by-case basis; new roads permitted when justified by mineral information
Developed recreation sites (MA 6)	Restricted	Avoidance area	Permitted	Restricted	Provide habitat	Unsuitable	Partial retention	Restricted
Big game winter range (MA 10)	Forest-wide standards apply	Avoidance area	Permitted with winter restrictions	Closed during winter	Maintain openings for big game	Unsuitable	See footnotes†‡	Restricted
Big game winter range/timber (MA 11)	Forest-wide standards apply	Avoidance area	Permitted with winter restrictions	Closed during winter	Maintain openings for big game	Suitable	See footnotes†‡	Restricted
Big game summer range (MA 12)	Forest-wide standards apply	Avoidance area	Frequently used facilities normally prohibited	Roads generally closed	Big game and grizzly habitat	Suitable	See footnote†	Restricted
Designated old growth timber (MA 13)	Forest-wide standards apply	Avoidance area	Restricted	Prohibited during summer/fall	Grizzly bear and old growth species habitat	Unsuitable	See footnotes†‡	Restricted
Grizzly habitat (MA 14)	Forest-wide standards apply	Avoidance area	Generally prohibited	Allowed, with restrictions	Grizzly habitat	Suitable	See footnote†	Restricted during active grizzly use
Timber production (MA 15)	Forest-wide standards apply	Permitted	Permitted	Allowed	Provide habitat	Suitable	Maximum modification	Allowed

Table 108. Summary of Relevant Standards in Selected Management Areas on the KNF. (cont'd).

Management Area	Locatable Mineral Development	Powerline Corridors	Lands and Facility Occupancy	Motorized Access	Wildlife	Timber Production	Visual Quality Objective	Road Development
Timber with viewing (MA 16)	Forest-wide standards apply	Permitted	Permitted	Allowed	Provide habitat	Suitable	Modification	Allowed
Viewing with timber (MA 17)	Forest-wide standards apply	Permitted	Permitted	Allowed	Provide habitat	Suitable	Partial retention	Allowed
Revegetation problem areas (MA 18)	Forest-wide standards apply	Permitted	Permitted	Allowed	Provide habitat	Unsuitable	See footnote†	Restricted
Electric Transmission Corridor (MA 23)	Forest-wide standards apply	Permitted	Permitted	Allowed, with possible public access restriction	Grizzly habitat	Unsuitable	Maximum modification	Allowed
Low Productivity Areas (MA 24)	Forest-wide standards apply	Case-by-case basis	Case-by-case basis	Allowed, with restrictions	Grizzly habitat	Unsuitable	See footnote†	Restricted
Mineral Development (MA 31)	Forest-wide standards apply	Case-by-case basis consistent with mineral production facility	Case-by-case basis consistent with mineral production facility	Allowed	Locate facilities, if possible, away from important winter range, calving areas, riparian areas, and meadows	Unsuitable	Maximum modification	Allowed

†Maximum modification in areas of low visual significance, modification in areas of moderate visual significance, and partial retention in areas of high visual significance.

‡Unless infeasible when attempting to meet the goals of the Management Area.

Source: USDA Forest Service 1987.

Developed Recreation Sites (MA 6). MA 6 includes developed campgrounds, picnic areas, boat ramps, and other developed recreation sites. Areas are usually associated with water features such as lakes, reservoirs, and streams. The goal of MA 6 is to provide safe and sanitary developed recreation in a setting that is pleasant and visually attractive. This MA is usually withdrawn from mineral development, and is classified as a corridor avoidance area (KFP Vol. 1 III-18).

Big Game Winter Range (MA 10). The goal of MA 10 is to maintain or enhance the habitat effectiveness for winter use by big-game species including elk, moose, sheep, goats, whitetail deer, and mule deer. The goal also is to maintain or enhance visual resources in areas visible from major travel corridors. This MA is classified as a corridor avoidance area (KFP Vol. 1 III-40).

Big Game Winter Range/Timber (MA 11). The goal for MA 11 is to maintain and enhance winter range habitat effectiveness for big game species while also producing a programmed yield of timber and maintaining the scenic resource in areas of high visual significance. The standards concentrate on protection of important wintering areas and providing optimum habitat for elk, mule deer, whitetail deer, moose, sheep, and goats for winter survival. These areas are corridor avoidance areas in grizzly bear habitat. Programmed timber harvest is authorized (KFP Vol. 1 III-45).

Big Game Summer Range/Timber (MA 12). The goal for MA 12 emphasizes maintenance or enhancement of summer and fall big game habitat while producing a programmed yield of timber. The goals and standards focus on providing big game habitat diversity for black bear, grizzly bear, elk, moose, mule deer, and whitetail deer. Timber production will be maintained through cultural treatments and regeneration harvest designed to reduce the frequency of entries. Facilities that require frequent maintenance or occupancy are normally not allowed. This MA is a corridor avoidance area in areas important to grizzly bear use (KFP Vol. 1 III-51).

Designated Old Growth Timber (MA 13). MA 13 provides the special habitat necessary for old growth-dependent wildlife on at least 10 percent of the land area within each major drainage, and in units that represent the major habitat types and tree species of each drainage. The standards emphasize providing diverse, high quality, year-round habitat for old growth-dependent wildlife (usually other than big game) by relying on natural processes of stand aging, decadence and eventual deterioration. This MA is classified as a corridor avoidance area (KFP Vol. 1 III-56).

Grizzly Bear Habitat/Timber (MA 14). MA 14 is designed to maintain or enhance grizzly bear habitat, reduce grizzly/human conflicts, assist in the recovery of the grizzly bear, realize a programmed level of timber production, and provide for the maintenance or enhancement of other wildlife, especially big game. Identified grizzly habitat components will be maintained or enhanced, and key components such as wet meadows and bogs will be mapped and managed as riparian areas. This MA is classified as a corridor avoidance area (KFP Vol. 1 III-60).

Timber Production (MA 15). The goal of MA 15 is to produce timber volumes suitable for harvest by conventional methods while providing for other resource values such as soil, air, water, wildlife, recreation and forage for domestic livestock. This MA has standards and guidelines for providing optimum timber production by ensuring full stocking through natural and artificial regeneration, and maintaining optimal volume growth through stocking control by thinning. Most roads are available for motorized recreation. Transmission line corridors are permitted (KFP Vol. 1 III-66).

Timber with Viewing (MA 16). The goal of MA 16 is to produce timber while providing for a pleasing view. This MA is characterized by productive forest land that has moderate viewing sensitivity. There are no identified habitats for threatened or endangered species. Most roads are available for motorized recreation. Transmission line corridors are permitted (KFP Vol. 1 III-71).

Viewing with Timber (MA 17). The goal of MA 17 is to provide landscapes that are pleasing to the viewer, while producing a level of timber production that is compatible with visual resource protection. Roads are generally located so they are not visible from major travel corridors. Transmission line corridors are permitted (KFP Vol. 1 III-76).

Regeneration Problem Areas (MA 18). MA 18 occurs on areas of slope in excess of 40 percent where timber productivity is moderate to high. This MA is distinguished by the difficulty in establishing coniferous regeneration after timber harvest. The goals of this MA are to maintain the existing coniferous vegetation until techniques and practices are available to ensure that timber can be harvested and the area adequately regenerated within 5 years of harvest, and to maintain viable populations of existing native wildlife species. Because of the sensitivity of MA 18, water quality and soil erosion will be monitored as part of any surface disturbance activity. Transmission line corridors are permitted (KFP Vol. 1 III-81).

Electric Transmission Corridor (MA 23). The goal for MA 23 is to provide for the transmission of electricity in a safe and efficient manner. The goal is also to protect the adjacent wilderness character, contribute to the diversity of surrounding wildlife habitat, and provide as much security as possible for the grizzly bear. The VQO is maximum modification (KFP Vol. 1 III-113).

Mineral Development (MA 31). The goal of MA 31 is to provide mineral production workers with safe and healthful working areas that are in concert with the surrounding MAs as much as possible. Additional sites for this MA will be provided as demand and successful mineral discoveries permit. The VQO is maximum modification (KFP amendments).

Riparian Areas. In 1995, the KNF amended the KFP to adopt the INFS (USDA Forest Service 1995) to establish stream, wetland, and landslide-prone area protection zones called RHCAs. These RHCAs are designated along most of the streams in the land use analysis area. Section 3.6, *Aquatic Life and Fisheries* provides more information about the standards and guidelines for managing activities within a RHCA.

3.14.4 Environmental Consequences

3.14.4.1 Alternative 1 – No Mine

The changes in land use associated with a mine would not occur. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Disturbances on private land at the Libby Adit Site would remain until reclaimed in accordance with existing permits and approvals. Use of National Forest System lands would continue to be managed in accordance with the KFP. Existing land use of private land in the Little Cherry Creek Tailings Impoundment Site and along the Bear Creek Road (NFS road #278) would continue.

3.14.4.2 Alternative 2 – MMC's Proposed Mine

Direct Effects

Most of the proposed mine facilities would be on National Forest System lands. The management emphasis of these lands is listed in Table 109. Most of the lands are currently managed for mineral development, wildlife habitat, recreation, and commercial timber production. During the life of the operation, use of the lands within the permit areas would be devoted to mining and associated activities. The permitted area and the disturbance along the Bear Creek access road (NFS road #278) would total 3,405 acres (Table 109); about 2,582 acres would be disturbed. Adjacent land use during the operation would be affected to some extent; these impacts are described in other sections on recreation, noise, scenic resources, and wildlife. The Libby Adit Site and portions of the Little Cherry Creek Impoundment Site (424 acres) are private lands owned by MMC (Table 109). LAD Area 2 would be immediately adjacent to private land along Libby Creek (Figure 77). Widening of the Bear Creek Road would affect about 7.6 acres of private land in three separate parcels between 1 and 3 miles south of the road's intersection with U.S. 2.

All lands disturbed by the project would be revegetated and, except for the Bear Creek Road and the tailings impoundment facilities, would return to pre-mine uses and productivity over time. The Bear Creek Road from U.S. 2 to the Bear Creek Bridge would not be restored to its narrower pre-mining width. Successful reclamation would result in reforestation of disturbed lands. The goal of reclamation would be to restore lands to productive use (see section 3.18, *Soils and Reclamation*). The Little Cherry Creek Tailings Impoundment and the upper part of the Diversion Channel would not support pre-mining timber production. The disturbance associated with the Bear Creek Road widening also would not support pre-mining timber production.

3.14.4.2.1 Forest Plan Amendment

A KFP amendment would be needed for portions of the mine permit areas that are not currently designated for mineral development (MA 31). A few areas currently designated for mineral development also would need to be reallocated to other Management Areas. Alternative 2 would require an amendment on 1,916 acres; 1,886 acres would be reallocated to MA 31 and 30 acres would be reallocated back to the MAs shown in Table 110. Under MA 31, land management in the mine permit areas would change from the present direction for uses listed in Table 110 to long-term management for mineral development. The MA that would require the most change is currently MA 14, which is managed for grizzly bear habitat. Because the permit area at the Ramsey Plant Site is better defined than in 1993, 25 acres at the site would be reallocated from MA 31 back to MA 2, semi-primitive non-motorized recreation. Similarly, 5 acres at the Little Cherry Creek Impoundment Site would be reallocated back to MA 14, grizzly bear habitat. Maps showing areas of proposed reallocation are available at the KNF.

Table 109. Management Area (MA) Allocation of Lands within Proposed Permit Areas and along Bear Creek Access Road.

Management Area	Alternative 2 – MMC's Proposed Mine	Alternative 3 – Agency Mitigated Poorman Impoundment Alternative	Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative
National Forest System lands			
MA 2-Semi-primitive non-motorized recreation	227	178	178
MA 11-Big game winter range/timber	20	20	20
MA 13-Old growth	341	259	289
MA 14-Grizzly habitat	1,006	1,481	1,115
MA 16-Timber with viewing	501	134	502
MA 17-Viewing with timber	34	<1	34
MA 23-Electric transmission corridor	65	23	23
MA 31-Mineral development	1,078	490	728
Subtotal	3,272	2,585	2,889
Private land			
MMC-owned	425	75	425
Other Private	8	8	8
Subtotal	433	83	433
Total	3,705	2,668	3,322

All units are in acres.

Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 110. Acres of National Forest System Land to be Reallocated to Management Area 31 (Mineral Development) for each Mine Alternative.

Management Area Allocation	Alternative 2 – MMC's Proposed Mine			Alternative 3 – Agency Mitigated Poorman Impoundment Alternative			Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative		
	To MA 31	From MA 31	Net to MA 31	To MA 31	From MA 31	Net to MA 31	To MA 31	From MA 31	Net to MA 31
MA 2-Semi-primitive non-motorized recreation	208	25	183	160	150	10	160	150	10
MA 13-Old growth timber[†]	336	0	336	252	0	252	284	0	284
MA 14-Grizzly habitat	815	5	810	1,363	466	897	951	228	723
MA 16-Timber with viewing	473	0	473	106	0	106	473	0	473
MA 17-Viewing with timber	34	0	34	0	0	0	34	0	34
MA 23-Electric transmission corridor	20	0	20	23	2	21	23	2	21
Total	1,886	30	1,856	1,904	618	1,286	1,925	380	1,545

Acreage based on the permit areas surrounding the adit sites, plant site, tailings impoundment, and LAD Areas.
[†]The KNF would reallocate 587 acres of old growth in Alternative 3 and 659 acres in Alternative 4 to MA 13 (Table 145). The stands of old growth have not been identified specifically, and would be before issuance of a ROD.
Source: GIS analysis by ERO Resources Corp. using KNF data.

3.14.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Like Alternative 2, most of the proposed mine facilities would be on National Forest System lands currently managed for wildlife habitat, recreation, mineral development, and commercial timber production. The management emphasis of these lands is shown in Table 109. During the life of the operation, use of the lands within the permit areas would be devoted to mining and associated activities. The permitted area and the disturbance along the Bear Creek access road (NFS road #278) would total 2,668 acres (Table 109); about 2,011 acres would be disturbed. Effects of Alternative 3 would be similar to Alternative 2. The Libby Adit Site is private land owned by MMC. The Poorman Impoundment Site and LAD Area 2 would be immediately west of private land along Libby Creek. Widening of the Bear Creek Road would affect about 7.6 acres of private land in three separate parcels between 1 and 3 miles south of the road's intersection with U.S. 2.

All lands disturbed by the project would be revegetated and, except for the Bear Creek Road and the tailings impoundment facilities, would return to pre-mine uses and productivity over time. The Poorman Tailings Impoundment and the disturbance associated with the Bear Creek Road widening would not support pre-mining timber production.

Alternative 3 would require a KFP amendment of 2,522 acres; 1,904 acres would be reallocated to MA 31 and 618 acres would be reallocated back to the MAs shown in Table 110. Under MA 31, land management in the mine permit areas would change from the present direction for uses listed in Table 110 to long-term management for mineral development. The MA that would require the most change is MA 14, which currently is managed for grizzly bear habitat. Because the permit area would not include Ramsey Plant Site, 150 acres at the Ramsey Plant Site would be reallocated back to MA 2, semi-primitive non-motorized recreation. Similarly, 466 acres at the Little Cherry Creek drainage (outside of the permit area for the tailings impoundment) would be reallocated back to MA 14, grizzly bear habitat. Maps showing areas of proposed reallocation are available at the KNF.

3.14.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Like the other alternatives, most of the proposed mine facilities in Alternative 4 would be on National Forest System lands currently managed for grizzly bear habitat (Table 109). Management emphasis of the permit area of other facilities is mineral development, recreation, and commercial timber production. During the life of the operation, use of the lands within the permit areas would be devoted to mining and associated activities. The permitted area and the disturbance along the Bear Creek access road (NFS road #278) would total 3,322 acres (Table 109); about 2,248 acres would be disturbed. Effects of Alternative 4 would be similar to Alternative 2. Land use of private land at the Libby Adit Site and the Little Cherry Creek Impoundment Site, which is owned by MMC, would not change. Widening of the Bear Creek Road would affect about 7.6 acres of private land in three separate parcels between 1 and 3 miles south of the road's intersection with U.S. 2.

All lands disturbed by the project would be revegetated and, except for the Bear Creek Road and the tailings impoundment facilities, would return to pre-mine uses and productivity over time. The Little Cherry Creek Tailings Impoundment, upper part of the Diversion Channel, and the

disturbance associated with the Bear Creek Road widening would not support pre-mining timber production.

The KFP would be amended to change the management allocation to mineral development (MA 31) on 2,305 acres from the present direction for uses listed in Table 110. About half the area is currently MA 14, which is managed for grizzly bear habitat. The permit area would not include Ramsey Plant Site, and 150 acres at the Ramsey Plant Site would be reallocated from MA 31 back to MA 2, semi-primitive non-motorized recreation. Similarly, 228 acres at the Little Cherry Creek Impoundment Site outside of the permit area for the tailings impoundment would be reallocated back to MA 14, grizzly bear habitat. Maps showing areas of proposed reallocation are available at the KNF.

3.14.4.5 Alternative A – No Transmission Line

In Alternative A, the transmission line and substation for the Montanore Project would not be built. No changes in land use in Alternative A would occur. Use of National Forest System lands would continue to be managed in accordance with the KFP. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Existing land use of state land along West Fisher Creek, Plum Creek lands, and private land along U.S. 2 and at scattered parcels in the Miller Creek, West Fisher Creek and Standard Creek drainages would continue.

3.14.4.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

3.14.4.6.1 Direct Effects

In the North Miller Creek Alternative, the alignment would cross Plum Creek land in the Fisher River valley and in three sections immediately west of the Fisher River (Figure 77). These segments would parallel an existing road corridors (roads on Plum Creek lands, U.S. 2 and NFS road #385). About 9.3 miles of the North Miller Creek Alternative (Alternative B) would be within 1,000 feet of open roads on Plum Creek lands, U.S. 2 or open roads on National Forest System lands, such as NFS road #231 or #278 (Table 111).

Table 111. Use of Existing Road Corridors.

Alternative	Miles of Centerline within 1,000 Feet of Existing Road Corridors
Alternative B –North Miller Creek Alternative	9.3
Alternative C – Modified North Miller Creek	8.5
Alternative D –Miller Creek	12.0
Alternative E – West Fisher Creek	11.1

Source: GIS analysis by ERO Resources Corp. using KNF data.

All transmission line alternatives would include the Sedlak Park Substation and loop line (steel monopoles would be used). The Sedlak Park Substation and loop line would affect 4.4 acres of Plum Creek land, all of which are covered by the conservation easement. About 7.2 miles of Plum Creek land would be crossed, 5.4 miles of which are covered by the conservation easement with FWP (Table 112). Two sections of Plum Creek land west of the Fisher River are not covered by the

conservation easement with FWP. Clearing of up to 129 acres of Plum Creek land, which is compatible with Plum Creek's land management, would be needed for the transmission line. About 10 acres of additional clearing would be needed for access road construction on private lands (Table 113). Following construction, the transmission line could restrict cable logging in areas adjacent to the line. Plum Creek land is managed primarily for timber production; some dispersed recreation also occurs on Plum Creek land. This alternative would cross less than 0.1 mile of other private land near the Fisher River.

The remaining 9.3 miles of North Miller Creek Alternative would be on National Forest System lands managed by the KNF. Because the alternative uses the same alignment that was approved in 1993, about a third of the alignment (3.1 miles) would cross lands currently managed for electric transmission corridors. The line would cross 3.0 miles of land that the KFP has identified as corridor avoidance areas (Figure 78; Table 112). Of the 3.0 miles of corridor avoidance areas, most (2.5 miles) are currently managed for big game winter range (MA 11), with the remaining 0.5 mile is split between four different MAs (Table 112). Fourteen residences are within 0.5 mile of this alignment (Figure 78), of which 11 are greater than 450 feet from the centerline of the ROW and the remaining three are within 450 feet (Asher Sheppard Consulting 2007). The alternative would pass through the Libby Creek Recreational Gold Panning Area for a distance of 1,761 feet (see section 3.15, *Recreation*).

All transmission line alternatives would require construction of between 3 and 10 new access roads or extensive upgrading of existing access roads (see Table 113). About 1.9 miles of roads would be constructed in areas where road construction is allowed under the KFP, and 5 miles of roads would be in areas where road construction is restricted in some manner (Table 113). For example, MA 11 indicates roads will normally be closed during big game winter use (December 1 to April 30). MMC proposes to restrict motorized activity associated with transmission line construction from April 1 to June 15 within bear habitat in the Miller Creek and Midas Creek drainages. MMC also would restrict transmission line construction during the winter in big-game winter range areas (MA 11).

3.14.4.6.2 Forest Plan Amendment

The North Miller Creek Alternative would require a KFP amendment on 302 acres; 220 acres would be reallocated to MA 23 and 82 acres would be reallocated from MA 23 to the MAs shown in Table 114. Under MA 23, land management along the line would change from the present direction for uses listed in Table 114 to long-term management as a transmission line corridor. The MA that would require the most change is MA 11, which currently is managed for big game winter range and timber production.

About 44 acres in the Ramsey Creek drainage would be reallocated from MA 23 to MA 2, 9 acres in the land use analysis area would be reallocated to MA 6, 11 acres would be reallocated to MA 13, and 17 acres would be reallocated to MA 14 (Table 114). Maps showing areas of proposed reallocation are available at the KNF.

Table 112. Management Area (MA) Allocation and Land Ownership of Each Transmission Line Alternative Excluding Sedlak Park Substation and Loop Line.

Management Emphasis	Alternative B – North Miller Creek		Alternative C – Modified North Miller Creek		Alternative D – Miller Creek		Alternative E – West Fisher Creek	
	(ac.)†	(mi.)	(ac.)†	(mi.)	(ac.)†	(mi.)	(ac.)†	(mi.)
National Forest System Land-transmission line corridor avoidance areas								
MA 6-Developed recreation sites	1	<0.1	1	<0.1	7	0.3	7	0.3
MA 11-Big game winter range/timber	44	2.5	63	2.6	39	1.6	83	3.5
MA 12-Big game summer range	5	0.3	8	0.3	55	2.3	42	1.7
MA 13-Old growth	3	0.1	0	0	6	0.2	6	0.2
MA 14-Grizzly habitat	2	0.1	1	0	1	0	2	<0.1
Subtotal	55	3.0	73	2.9	108	4.4	140	5.7
National Forest System Land-transmission line corridors allowed								
MA 15-Timber production	24	1.3	31	1.3	9	0.4	6	0.3
MA 16-Timber with viewing	0	0	<1	<0.1	34	1.4	34	1.4
MA 18-Regeneration problem areas	26	1.5	29	1.2	0	0.0	0	0.0
MA 23-Electric transmission corridor	54	3.1	23	1	12	0.5	12	0.5
MA 31-Mineral development	8	0.4	0	0	0	0	0	0
Subtotal	112	6.3	83	3.5	55	2.3	52	2.2
State Land	0	0.0	0	0.0	0	0.0	24	1.2
Private Land								
Plum Creek with conservation easement	97	5.4	128	5.3	128	5.3	103	4.2
Other Plum Creek	32	1.8	40	1.7	41	1.7	30	1.3
Other private	1	<0.1	0	0	11	0.4	4	0.2
Subtotal Private	130	7.2	168	6.9	180	7.4	137	5.7
Total	297	16.4	324	13.4	343	14.1	355	14.9

†Acreage is based on a 150-foot clearing width for monopoles (Alternative B) and 200-foot width for H-frame structures (other alternatives except for a short segment of the West Fisher Creek Alternative that has monopoles). Actual acreage cleared would be less than listed and would depend on tree height, slope, and line clearance above the ground.

Totals may vary slightly due to rounding.

Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 113. Estimated Road Construction or Reconstruction in Each Transmission Line Alternative.

MA Direction on Road Development†	Alternative B – North Miller Creek		Alternative C – Modified North Miller Creek		Alternative D – Miller Creek		Alternative E – West Fisher Creek	
	(ac.)	(mi.)	(ac.)	(mi.)	(ac.)	(mi.)	(ac.)	(mi.)
National Forest System Lands - Road Construction Allowed (MAs 15, 16, 17, 23, 31)	5.8	1.9	0.3	0.1	1.8	0.6	1.8	0.6
National Forest System Lands - Road Construction Restricted (MAs 2, 6, 10, 11, 12, 13, 14, 17, 18, 24)	14.7	5.0	2.3	0.8	1.6	0.6	5.0	1.7
State Lands	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.2
Private Lands	10.0	3.4	6.6	2.2	6.6	2.2	5.4	1.7
Total	30.5	10.3	9.2	3.1	10.0	3.4	12.7	4.2

New roads and roads with extensive requirements for upgrading are assumed to be 25 feet wide. Values are rounded to the nearest 0.1 acre and mile, and conversion between the two may vary due to rounding.
†(See Table 108.)
Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 114. Acres of KNF land to be Reallocated to Management Area 23 (Electric Transmission Corridor) for each Transmission Line Alternative.

Management Area Emphasis	Timber Harvest	Alternative B – North Miller Creek			Alternative C – Modified North Miller Creek			Alternative D – Miller Creek			Alternative E – West Fisher Creek		
		To MA 23	From MA 23	Net to MA 23	To MA 23	From MA 23	Net to MA 23	To MA 23	From MA 23	Net to MA 23	To MA 23	From MA 23	Net to MA 23
MA 2-Semi-primitive non-motorized recreation	Unsuitable	16	44	-29	0	126	-126	0	126	-126	0	126	-126
MA 6-Developed recreation sites	Unsuitable	9	9	-1	9	9	-1	25	21	4	25	21	4
MA 10-Big game winter range	Unsuitable	0	0	0	0	0	0	0	0	0	4	0	4
MA 11-Big game winter range/Timber	Suitable	145	0	145	153	0	153	97	0	97	206	0	206
MA 12-Big game summer range	Suitable	19	0	19	20	0	20	137	0	137	106	0	106
MA 13-Old growth timber[†]	Unsuitable	15	11	4	0	23	-23	14	23	-9	15	23	-8
MA 14-Grizzly habitat	Suitable	17	17	-1	9	26	-18	6	41	-34	11	41	-29
Total		220	82	138	190	184	6	279	210	69	366	210	156

Acreage calculated on the basis of a 500-foot corridor along transmission line centerline to allow for flexibility during final design of the line.
[†]The KNF would reallocate 39 acres of old growth in Alternative C and, in addition, 64 acres in Alternatives D and E (Table 146). The stands of old growth have not been identified specifically, and would be before issuance of a ROD.
Source: GIS analysis by ERO Resources Corp. using KNF data.

3.14.4.7 Alternative C – Modified North Miller Creek Transmission Line Alternative

3.14.4.7.1 Direct Effects

The Sedlak Park Substation and loop line would affect 4.4 acres of Plum Creek land, all of which are covered by the conservation easement. The Modified North Miller Creek Alternative would affect Plum Creek land in the Fisher River valley and in three sections immediately west of the Fisher River similar to the North Miller Creek Alternative (Figure 77). About 6.9 miles of Plum Creek land would be crossed, 5.3 miles of which are covered by the conservation easement with FWP. No other private land would be affected (Table 112). This alternative would use H-frame structures, which have a wider clearing width than the monopoles proposed in Alternative B; up to 168 acres of Plum Creek land would require clearing for the transmission line. Some additional clearing would be needed for access road construction (Table 113). Alternative C would make the least use of existing road corridors, with 8.5 miles within an existing road corridor (Table 111).

The remaining 6.4 miles of the Modified North Miller Creek Alternative would be on National Forest System lands with a management area allocation shown in Table 112. The line would cross 2.9 miles of corridor avoidance areas (Table 112). Of the 2.9 miles of corridor avoidance areas, most (2.6 miles) currently are managed for big game winter range (MA 11). All seven residences within 0.5 mile of this alignment are more than 450 feet from the centerline (Asher Sheppard Consulting 2007). Like Alternative B, Alternative C would pass through the Libby Creek Recreational Gold Panning Area in the same location.

A minimum of 20 structures (about 3.3 miles of line) would be set using a helicopter, minimizing new access road construction or extensive upgrading of closed roads). Additional structures may be set using a helicopter at the contractor's discretion. About 0.1 mile of roads would be constructed in areas where road construction is allowed under the KFP, and 0.8 mile of roads would be in areas where road construction is restricted in some manner (Table 113).

3.14.4.7.2 Forest Plan Amendment

The Modified North Miller Creek Alternative would require 190 acres of KNF land be changed from the MA designation shown in Table 114 to MA 23; 184 acres would be changed from MA 23 to the MA shown in Table 114. Most of the lands that would be reallocated to MA 23 would be MA 11, big game winter range/timber, and big game summer range.

Most of the land that would be reallocated from MA 23 (126 acres) would be allocated to MA 2 in the Ramsey Creek drainage. In the land use analysis area, 9 acres would be reallocated from MA 23 to MA 6, 23 acres would be reallocated to MA 13, and 26 acres would be reallocated to MA 14 (Table 114). Maps showing areas of proposed reallocation are available at the KNF.

3.14.4.8 Alternative D – Miller Creek Transmission Line Alternative

3.14.4.8.1 Direct Effects

The Miller Creek Alternative would have essentially the same effect on Plum Creek land in the Fisher River valley and in three sections immediately west of the Fisher River as the Modified North Miller Creek Alternative. This alternative also would use H-frame structures; up to 169 acres of Plum Creek land would require clearing for the transmission line. Some additional clearing would be needed for access road construction. It would make best use of existing road corridors, with 12 miles with 1,000 feet of existing, open roads (Table 111).

Two other private land parcels would be affected (Figure 77). The line would be on the north side of a private parcel with a cabin along Miller Creek (Figure 78). It also would cross the northeast corner of a private parcel south of Howard Lake. A residence has recently been built on the south end of this parcel. Preliminary design indicates one H-frame structure and one access road to the structure would be needed on each parcel. A total of 11 acres of clearing would be required on the two parcels (Table 112).

The remaining 6.7 miles of the Miller Creek Alternative would be on National Forest System lands with a management emphasis shown in Table 112. The line would cross 4.4 miles of corridor avoidance areas, most of which (3.9 miles) currently are managed for big game winter and summer range (MAs 11 and 12 – Table 112). All seven residences within 0.5 mile of this alignment are more than 450 feet from the centerline (Asher Sheppard Consulting 2007). The alignment would pass through the Libby Creek Recreational Gold Panning Area for a distance of 2,118 feet (see section 3.15, *Recreation*).

A minimum of 20 structures (about 2 miles of line) would be set using a helicopter; additional structures may be set using a helicopter at the contractor's discretion. About 0.6 mile of roads would be constructed in areas where road construction is allowed under the KFP, and 0.6 mile of roads would be in areas where road construction is restricted in some manner (Table 113).

3.14.4.8.2 Forest Plan Amendment

The Miller Creek Alternative would require a KFP amendment on 489 acres; 279 acres would be reallocated to MA 23 and 210 acres would be reallocated from MA 23 to the MAs shown in Table 114. The MA that would require the most change is MA 11, which currently is managed for big game winter range and timber production.

Like Alternative C, most of the land that would be reallocated from MA 23 (126 acres) would be allocated to MA 2 in the Ramsey Creek drainage. As shown in Table 114, 21 acres in the land use analysis area would be reallocated from MA 23 to MA 6, 23 acres would reallocated to MA 13, and 41 acres would be reallocated to MA 14. Maps showing areas of proposed reallocation are available at the KNF.

3.14.4.9 Alternative E – West Fisher Creek Transmission Line Alternative

3.14.4.9.1 Direct Effects

The West Fisher Creek Alternative would have less effect on Plum Creek land than the other alternatives, crossing 6.7 miles of Plum Creek lands and 4.2 miles of lands covered under the conservation easement. This alternative would use H-frame structures, except in the section of state land west of the Fisher River (Figure 77). Up to 157 acres of Plum Creek land would require clearing for the transmission line. Some additional clearing would be needed for access road construction. The Sedlak Park Substation and loop line would affect 4.4 acres of Plum Creek land, all of which are covered by the conservation easement.

One private land parcel south of Howard Lake would be affected (Figure 77). This alternative would have the same effect on this parcel as the Miller Creek Alternative. Preliminary design indicates one H-frame structure would be needed on the parcel. Up to 4 acres of clearing would be required on the parcel (Table 112). This alternative would cross 1.2 miles of state land managed for timber harvest (Table 112). Up to 24 acres of state land would require clearing for construction of the transmission line.

The remaining 6.7 miles of the West Fisher Creek Alternative would be on National Forest System lands with a management emphasis shown in Table 112. The line would cross 4.4 miles of corridor avoidance areas, most of which currently are managed for big game winter and summer range (MAs 11 and 12 – Table 112). Six residences are within 0.5 mile of this alignment, of which four are more than 450 feet from the line and the remaining two are within about 450 feet of the centerline (Asher Sheppard Consulting 2007). The alignment would pass through the Libby Creek Recreational Gold Panning Area. About 11.1 miles of the centerline would be with 1,000 feet of existing, open roads (Table 111).

A minimum of 23 structures (about 2.4 miles of line) would be set using a helicopter; additional structures may be set using a helicopter at the contractor's discretion. About 0.6 mile of roads would be required in areas where road construction is allowed under the KFP, and 1.7 miles of roads in areas where road construction is not allowed (Table 113).

3.14.4.9.2 Forest Plan Amendment

The West Fisher Creek Alternative would require 366 acres of KNF land be changed from the MA designation shown in Table 114 to MA 23; 210 acres would be changed from MA 23 to the MA shown in Table 114. Most of the lands that would be reallocated to MA 23 would be MA 11, big game winter range/timber, and big game summer range.

Most of the land in the Ramsey Creek drainage that would be reallocated from MA 23 would be allocated to MA 2. As shown in Table 114, 21 acres in the land use analysis area would be reallocated from MA 23 to MA 6, while 23 acres would be reallocated to MA 13, and 41 acres would be reallocated to MA 14. Maps showing areas of proposed reallocation are available at the KNF.

3.14.4.10 Cumulative Effects

Past actions, such as past mining and road construction, have altered the existing land use. Areas disturbed by past mining and road construction do not provide for timber production or wildlife habitat. Past KFP amendments have changed the MA designations of National Forest System lands. In 1987 when the KFP was issued, the KNF had 1,690 acres allocated to MA 23; MA 31 was not established. Since 1987, the KFP has been amended to allocate 3,473 acres to MA 23 and 1,245 acres to MA 31. In the land use cumulative effects analysis area, previous amendments have allocated 233 acres to MA 23 and 1,108 acres to MA 31. The Rock Creek Project and the Montanore Project would cumulatively increase the amount of National Forest System lands on the KNF managed for transmission line corridors and mineral development.

3.14.4.11 Regulatory/Forest Plan Consistency

Following the amendments to the KFP described in this section and in section 2.12, *Forest Plan Amendment*, the mine and transmission line alternatives would be in compliance with the management area designations of the KFP. Other sections of Chapter 3 discuss compliance with the KFP. If the selected transmission line were approved by the FWP, it would be in compliance with the FWP-Plum Creek conservation easement.

3.14.4.12 Irreversible and Irretrievable Commitments

The tailings impoundment area, about 600 acres in each mine alternative, would be managed for mineral development following operations, and would no longer be managed as suitable for

timber production. The area covered by asphalt and gravel by widening the Bear Creek Road would not be returned to pre-mine uses. Timber would be harvested sooner in areas cleared for project facilities. Continued tree clearing along the transmission line would reduce timber production during the life of the project. These resources would be irretrievably affected. Any indirect development associated with the project, such as new permanent residential or commercial development in or around Libby, would likely be permanent.

3.14.4.13 Short-term Uses and Long-term Productivity

In the short term, mine operations would dominate land use on about 2,700 to 3,700 acres, depending on the alternative. Similarly, timber production on 300 to 350 acres, depending on the transmission line alignment, would be eliminated along the transmission line clearing width and access roads. Actual clearing width and lost timber production would be slightly less, and would depend on tree height, slope, and line clearance above the ground. After operations ceased, land uses in most areas affected by the mine, Sedlak Park Substation and loop line, and transmission line would return to pre-mine uses. In addition, an undetermined amount of private land would be acquired and legally dedicated to long-term grizzly bear habitat mitigation (see section 3.24, *Wildlife Resources*).

3.14.4.14 Unavoidable Adverse Environmental Effects

During mine and transmission line construction and operations, all action alternatives would unavoidably alter land use in the land use analysis area.

3.15 Recreation

3.15.1 Regulatory Framework

3.15.1.1 Kootenai Forest Plan

The Forest-wide Management Direction objectives for recreation outlined in the KFP allows for the maintenance and expansion of trails and developed recreation opportunities (such as campgrounds, picnic areas, and boat launches) as needed to prevent resource damage or to accommodate increased demand, and the expansion of groomed cross-country ski trails and snowmobile trails. The Forest Travel Planning process is used to review, evaluate, and implement the goals and standards of various MAs, with regard to roads, trails, and motorized vehicle use (USDA Forest Service 1987). MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*. Management emphasis for individual MAs are described in section 3.14, *Land Use* (Table 108). Executive Order 12962 mandates disclosure of effects to recreational fishing.

3.15.1.2 State and Local Plans

The FWP manages wildlife populations and establishes limits on fishing and hunting activities statewide including on National Forest System lands. FWP has several general statewide goals that relate to recreational use in the analysis area (FWP 2009). FWP's goals are to provide quality opportunities for public appreciation and enjoyment of fish, wildlife, and parks resources, and maintain and enhance the health of Montana's natural environment and the vitality of its fish, wildlife, cultural, and historic resources through the 21st century. The FWP's goals are not enforceable standards. Lincoln County does not have a comprehensive recreation plan.

One parcel of state land is crossed by the West Fisher Creek alignment. The DNRC manages the surface and mineral resources for the benefit of the common schools and six administrative land offices, under the direction of the State Board of Land Commissioners. Hunting also occurs on state land (Power Engineers 2005c).

3.15.2 Analysis Area and Methods

The analysis area includes the area west of U.S. 2, primarily east of the Cabinet Mountains ridge line (except for a ventilation adit located near Rock Lake on the west side of the ridge line), south from the Bear Creek Road corridor and north from NFS road #231. The four transmission line alternative alignment corridors also are included in the analysis area.

A land use inventory of the analysis area, which refined and updated existing recreation-related data, was used for the evaluation of recreation effects (Power Engineers 2005c). One of the components contained in the land use inventory included parks, recreation, and preservation areas. The analysis of recreational impacts was based on the number of roads and trails proposed for closure and the effect these closures would have on recreational access in the area. In addition, secondary effects associated with diminished recreation quality on lands adjacent to mining activities were evaluated.

The analysis of potential changes to Recreation Opportunity Spectrum (ROS) characteristics was based on existing ROS designations provided by KNF. Anticipated changes to ROS

characteristics along existing and proposed road corridors, adjacent to proposed mine facilities, and along proposed transmission line corridors were mapped and quantified. These anticipated changes are described in this section. Maps showing existing and anticipated ROS characteristics are available in the project record.

3.15.3 Affected Environment

3.15.3.1 Recreational Opportunities and Uses

Northwest Montana is known for its lakes, rivers, and mountains that provide a variety of recreational opportunities. National Forest System lands make up a large percentage of the Lincoln County land base and offer public access for a variety of motorized and non-motorized recreational activities including: hunting for big game and upland game birds, fishing, hiking, wildlife observation, photography, backpacking, horseback riding, snowmobiling, cross-country skiing, mountain biking, picnicking, sightseeing, off highway vehicle (OHV) use, rock hounding, and camping. Recreational use in the analysis area occurs largely within the 350,000-acre Libby Ranger District. Recreational use of the Libby Ranger District is highest in the summer with camping, hiking, and fishing on the weekends being the major activities. These activities in the analysis area are concentrated at Howard Lake and along popular hiking trails. Recreation activities continue to take place during fall, although use declines. Fall use of the analysis area is mainly dispersed hunting and berry picking.

In the last two decades, the number and types of users have increased in the analysis area, partly as a result of growth in the Flathead Valley and Missoula (Kocis *et al.* 2003). The analysis area provides different types of user experiences; the CMW and the small drainages provide users with a more solitary experience compared to the more structured user experience at Howard Lake or the Libby Creek Recreational Gold Panning Area. The KNF has management responsibility for recreational uses of these lands.

KNF uses the ROS inventory as a tool for defining classes of outdoor recreation opportunity environments, making management decisions, and as a way to communicate recreation priorities with the public (USDA Forest Service 1982). ROS classifies recreational opportunities into six categories: Primitive, Semi-Primitive Non-Motorized, Semi-Primitive Motorized, Roaded Natural, Roaded Modified, and Rural (Table 115) (USDA Forest Service 1990).

The Forest Service currently classifies the Poorman Creek and Ramsey Creek drainages as Semi-Primitive Motorized, while the Libby Creek drainage and the major access corridors are classified as Roaded Natural. Most of the remaining areas outside of CMW are Semi-Primitive Non-Motorized.

3.15.3.1.1 Hunting

In Montana, 24 percent of residents hunt, the highest level of participation in the nation (FWP 2005). Every fall, hunters frequent the hunting districts close to Libby. The FWP conducts an annual statewide harvest survey to determine hunter activity throughout the state. Data for hunter activity in the analysis area are summarized in Table 116. The Libby Ranger District has 14 permitted outfitters with five operating in the south end of the district. Three outfitters and guides (permitted for service days by both the Cabinet and Libby Ranger Districts) operate in an area near the proposed mining project (Jeresek, pers. comm. 2006a).

Table 115. ROS Characteristics.

ROS Category	Description
Primitive	Characterized by essentially unmodified natural environment of fairly large size. Interaction between users is fairly low and evidence of other users is minimal. Motorized use is not permitted.
Semi-Primitive Non-Motorized	Characterized by predominantly natuarl or natural-appearing environment of moderate to large size. Interaction between users is low, but there is often evidence of other users. Motorized use is not permitted.
Semi-Primitive Motorized	Characterized by predominantly natural or natural-appearing environment of moderate to large size. Concentration of users is low, but there is often evidence of other users. Motorized use is permitted.
Roaded Natural	Characterized by predominantly natural appearing environment with moderate evidence of human sights/sounds. Interaction between users is may be low to moderate, with evidence of other users prevalent. Conventional motorized use is provided for in the construction and design of facilities.
Roaded Modified	Characterized by modified natural environment with moderate to high evidence of human sights/sounds. Interaction between users is moderate to high, with evidence of other users prevalent. Conventional motorized use is provided for in the construction and design of facilities.
Rural	Characterized by substantially modified natural environment. Resource modification and utilization practices are primarily to enhance specific recreation activities and to maintain vegetative cover and soil. Sights and sounds of man are readily evident, and the interaction between users is often moderate to high. Facilities for intensified motorized use and parking are available.

Source: KFP, USDA Forest Service 1987.

Table 116. Analysis Area Hunter Activity by Hunting District.

Hunting District	Location	Species	Year	Hunters	Hunter Days
104	West of U.S. 2	Black Bear	2002	655	4,967
105	West of U.S. 2	Black Bear	2002	943	7,499
103	East of U.S. 2	Elk	2006	2,178	16,648
104	West of U.S. 2	Elk	2006	1,339	10,763
100	West of U.S. 2 and East of Montana 58	Goat	2005	7	63
105	West of U.S. 2	Moose	2006	25	199
106	East of U.S. 2	Moose	2006	15	180
123	West of U.S. 2	Sheep	2005	5	35
103	East of U.S. 2	White-tailed and Mule Deer	2006	3,690	25,834
104	West of U.S. 2	White-tailed and Mule Deer	2006	2,210	16,705

Note: The analysis area generally includes only small portions of the much larger Hunting Districts. Hunter days are defined as the number of days or partial days spent hunting by active hunters.
Source: FWP 2007.

Hunting opportunities also are available on private lands as a result of FWP actions through the block management program and conservation easements. The block management program is a cooperative effort between FWP, landowners, and land management agencies to provide free public hunting access to private and isolated public land. Other lands with conservation easements generally offer some level of public hunting access. Hunting in the analysis area occurs on Plum Creek lands covered by a conservation easement, other private lands and also on state school trust land. Hunting on private land is subject to landowner discretion.

3.15.3.1.2 Fishing

Fishing opportunities within the analysis area occur primarily in easily accessible streams and rivers and at Howard Lake. Other lakes in the CMW, including Leigh Lake, Rock Lake, and Geiger Lake, provide additional fishing opportunities. Fishing is a relatively minor activity in Poorman Creek and West Fisher Creek. Most fishing in the analysis area occurs on the Fisher River and Howard Lake (FWP 2008d). The FWP does not track fishing use of Little Cherry Creek, Standard Creek, and Miller Creek because they provide a very small portion of the recreational fishing opportunity.

3.15.3.1.3 Scenic Driving

Scenic driving occurs along the forest roads within the analysis area. The most heavily used roads are the Libby Creek Road (NFS road #231), the Bear Creek Road (NFS road #278), and U.S. 2. Less traveled roads used for scenic driving connect with these primary roads.

3.15.3.1.4 Camping and Picnicking

Howard Lake Campground is the only fee campground within the analysis area. This campground offers swimming, fishing, hiking, boating, a water well, RV sites, and toilets. A maintained trail provides access to dispersed camping on one side of the lake. Easy access to Libby Creek and Libby Lakes trailhead facilitates other recreational opportunities in the area. Average annual use

by campers paying the fee for Howard Lake Campground during the 2002 to 2004 seasons was 185 campsites (556 campers). Recreationists engaged in day use activities dominate Howard Lake Campground. Recreation visits to Howard Lake are about 3,000 annually (Power Engineers 2005c).

3.15.3.1.5 Forest Product Gathering

Firewood gathering, Christmas tree cutting, and huckleberry and mushroom picking occur in the analysis area. Firewood is collected primarily in the spring and fall, but because of the large number of wood-burning stoves in the area, firewood collection is constant. The Forest Service considers huckleberry picking to be an important recreational use of the area, although no information is available concerning the number of individuals who visit the area for this purpose, or the economic values that may result (Jeresek, pers. comm. 2006b). Huckleberry season (late summer through early fall) brings many people to the area to take part in the berry harvest. The Forest Service estimates that about 80 percent of the pickers are local residents (Jeresek, pers. comm. 2006b).

3.15.3.1.6 Gold Panning

The Libby Creek Recreational Gold Panning Area offers the general public the opportunity to pan for gold in a historical area of placer mining. The area has no developed parking lots or camping facilities. Camping at the area is primitive with dispersed sites.

3.15.3.1.7 Winter Activities

Winter activities include ice fishing, cross-country skiing, and snowmobiling. Winter activities in the analysis area are the most common near Bear Creek and Poorman Creek, which provide good areas for skiing and snowmobiling. Bear Creek Road is plowed all winter by Lincoln County to about 1 mile north of Bear Creek, providing skiing and snowmobiling access to Bear Creek and Poorman Creek areas. Libby Creek Road is currently plowed by Lincoln County to Crazyman Road (NFS road #6209), about 1 mile south of U.S. 2. Some winter activities occur on the unplowed portion of Libby Creek Road. Ice fishing occurs on Howard Lake.

3.15.3.1.8 Trails

Several trails access the CMW within the east side of the analysis area (Bear Creek south to West Fisher Creek) (Figure 79). These trails are: Trail 119 Libby Creek, Trail 820 Ramsey Creek, Trail 129 Poorman Creek, Trail 821 Cable Creek, Trail 116 Standard Creek, and Trail 117 Great Northern Mountain. Other trails near the transmission line alternatives include Trail 716 Libby Divide, Trail 118 Miller Creek, Trail 6S Divide 6 Trail, and Trail 859 Kenelty Caves Trail. Some of these designated trails are located on roads that are closed to motorized use. The road portions of these trails have been managed as trails since 1981, unless administrative use has required a higher level of access (Power Engineers 2005c). Other trails within or in proximity to the analysis area are shown in Figure 79.

The Libby Ranger District has two types of trailheads—managed and unmanaged. The Leigh Lake trailhead is the only managed trailhead in the analysis area. The trail is accessible from May 1 to September 30. Between 2001-2003, the average number of annual visitors at Leigh Lake was 2,827 and the average number of visitor days (equivalent to one person using the resource for 12 hours) was 3,485 (Power Engineers 2005c). Data was not available for non-managed trails. These trails are generally lightly used, with most of the activity occurring in the summer and fall.

Seasonal use data for managed trailheads and unmanaged trailheads indicate a gradual increase in wilderness use since 1988. Seasonal use data reflect high use during the summer (about 85 percent of total), moderate use during the fall (about 10 percent), and light use during the winter (about 5 percent) (MMI 2005a).

3.15.4 Environmental Consequences

The road closures described below would restrict both summer and winter recreation access for a variety of recreational uses, including hiking, hunting, fishing, OHV use, snowmobiling, cross-country skiing, berry picking, dispersed camping, and other uses in the affected areas. Secondary effects to recreation activities on lands adjacent to mine facilities would occur from mine- and construction-related noise and disturbance.

3.15.4.1 Alternative 1 – No Mine

Alternative 1 would have no impact upon recreation in the analysis area. Access to roads and trails would continue as in the past. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Visitors to the area may experience increased noise levels from activities at the Libby Adit Site. These effects would be temporary and there would be no long-term effects to visitors' recreational experiences if no mine were constructed.

3.15.4.2 Alternative 2 – MMC's Proposed Mine

3.15.4.2.1 Short-term Effects During Construction, Operations, and Reclamation Phases

In general, recreational use and access to the analysis area would continue, although the configuration of some access roads would change slightly and the overall character of recreation opportunities within or adjacent to mine facilities would change substantially. Short-term effects during mine construction, operation, and reclamation would include restricted public access, increased noise, and increased night lighting within and adjacent to the mine facility areas. Public motorized and non-motorized access would be restricted to mine and agency personnel in all permit areas. These effects would reduce the amount of area available for hunting and other dispersed recreation activities.

The proposed mine and associated facilities in Alternative 2 would reduce public recreational access due to road closures. Public motorized and non-motorized access would be restricted to mine and agency personnel in all permit areas. Specific road closures would include the Little Cherry Loop Road (NFS road #6212) within the proposed Little Cherry Creek Tailings Impoundment Site, the Poorman Creek Road (NFS road #2317) in the lower portion of the Poorman Creek drainage, and NFS road #4784 in the Bear Creek drainage (which is already proposed for an access change as part of the Rock Creek Project mitigation).

Prior to mine operation, Libby Creek Road (NFS road #231) and Upper Libby Creek Road NFS road #2316 would be plowed in the winter as part of a 2-year Libby Adit evaluation program and a 1-year Bear Creek Road (NFS road #278) reconstruction. The improvements to the Bear Creek Road would improve recreational access to the area, although the section of road that would not be improved could be unsafe for users. Because the Bear Creek Road would be plowed in the

winter, it would improve winter recreation access to the analysis area. Similarly, the Libby Creek Road would be plowed for 2 to 3 years during construction, improving winter recreation access to areas off of the road. Snowmobile and cross country skiing use of the Libby Creek Road and parts of Upper Libby Creek Road during construction, and of the Bear Creek Road during mine life would be eliminated.

Access restrictions at the permit area boundary of each mine facility would eliminate access to all roads within the permit boundary that are currently closed to motorized use but open to non-motorized use. These closures would eliminate non-motorized access to the Poorman Creek and Ramsey Creek drainages (NFS road #2317 and NFS road #4781, respectively). Similarly, non-motorized access to existing trails in the Poorman Creek (Trail 129) and Ramsey Creek (Trail 820) would be lost. Non-motorized trail access up the Libby Creek drainage (Trail 119) would not be affected.

The overall character of the trail user experience would be altered in the Libby Creek drainage due to noise, traffic, and visual effects associated with the proposed facilities. Within the CMW and the adjacent Cabinet Face East IRA, the recreational enjoyment of trails, lakes, and overall wilderness values in the upper Ramsey Creek drainage may be adversely affected due to the construction, operation, and reclamation of the Ramsey Plant Site (see also sections 3.19, *Sound, Electrical and Magnetic Fields, Radio and TV Effects* and 3.23, *Wilderness and Inventoried Roadless Areas*). Visual effects to user experience due to the construction and operation of proposed facilities are described in section 3.16, *Scenery*. The proposed Rock Lake Ventilation Adit, located east of Rock Lake on a small parcel of private land within the CMW, would potentially be visible from some locations within the CMW. The surface features at the ventilation shaft and the overall effect of those features would be minimal and would not affect recreation.

The Howard Lake Campground and the Libby Creek Recreational Gold Panning Area would not be directly affected by any of the proposed facilities or road closures, but may be subject to increased use due to better road access and familiarity among mine employees in the area. The combination of mine development and improved recreational access may displace some dispersed recreation activities (such as hunting, hiking, and dispersed camping). Individuals who are currently accustomed to these areas may move on to other areas of the forest with fewer visitors and developed facilities.

In Alternative 2, Little Cherry Creek would be diverted in a permanent Diversion Channel around the impoundment. Most of the diversion would be within the operating permit area for the tailings impoundment, and access would be restricted. In the 1993 KNF ROD on the Montanore Project, the KNF and FWP agreed that the "limited access to the affected length of Little Cherry Creek warrants a loss estimate of 383 angler-hours of recreational potential regardless of existing use levels" (USDA Forest Service 1993). The fisheries mitigation proposed by MMC in Alternative 2 was identified as adequate mitigation for the loss of recreational opportunity in the KNF's 1993 ROD.

3.15.4.2.2 Changes to Recreation Setting

During mine operations, the level of mine facility development proposed in Alternative 2 would change the ROS characteristics for some portions of the analysis area. The Ramsey Creek drainage within the analysis area would change from Semi-Primitive Motorized to Rural in character, while the Libby Creek drainage through the analysis area would change from Roaded

Natural to Rural. As in all action alternatives, the Bear Creek Road (NFS road #278) corridor would remain Roaded Natural from U.S. 2 to the impoundment site, and would change to Rural near the impoundment site, LAD Areas, and plant site. These changes from less developed to more developed recreation settings would likely displace some recreationists seeking a more remote and dispersed recreation experiences. The Libby Creek Road (NFS road #231) would remain as Roaded Natural. Estimated changes to ROS characteristics within the analysis area, in acres, are shown in Table 117.

Table 117. Change in Acres of ROS Characteristics within the Analysis Area, Mine Alternatives.

ROS Category	Alternative 1 – No Mine (Existing Conditions)	Alternative 2 – MMC's Proposed Mine	Alternative 3 – Agency Mitigated Poorman Impoundment Alternative	Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative
Primitive	67	67 (0)	67 (0)	67 (0)
Semi-Primitive Non-Motorized	4,821	3,377 (-1,704)	3,703 (-1,118)	3,730 (-1,091)
Semi-Primitive Motorized	534	108 (-426)	487 (-47)	488 (-46)
Roaded Natural	5,685	3,748 (-1,936)	4,058 (-1,627)	3,684 (-2,000)
Roaded Modified	2,130	1,694 (-436)	1,745 (-385)	1,645 (-485)
Rural	0	4,502 (+4,502)	3,176 (+3,176)	3,623 (+3,623)

(#) change from existing conditions due to the alternative.
Total analysis area is 13,236 acres.
Source: GIS analysis by ERO Resources Corp. using KNF data.

3.15.4.2.3 Long-term Effects After Closure

The long-term effects to recreation after completion of mine operations and reclamation include the elimination or closure of several roads within the permit boundary. Motorized access to the Little Cherry Creek Loop road (NFS road #6212) within the Little Cherry Creek Tailings Impoundment Site would change due to the tailings impoundment, reducing motorized access for scenic driving, hunting, fishing, and other uses.

Over the long term, public access would be restored to portions of NFS road #5182 through the Little Cherry Creek Tailings Impoundment Site and NFS road #4781 through LAD Area 2. The restoration of access along NFS road #4781 would provide long-term motorized access to the Poorman Creek drainage (NFS road #2317/Trail 129) and both motorized and non-motorized access to the Ramsey Creek drainage (motorized access along NFS road #4781 and non-motorized access to Trail 820).

No long-term effects to trail user access or experiences in the CMW, the Howard Lake Campground, and the Libby Creek Recreational Gold Panning Area would occur. With the exception of the tailings impoundment area, the long-term ROS characteristics throughout the analysis area would return to preexisting categories as disturbed areas become successfully revegetated and tree cover returns to pre-mine conditions. The tailings impoundment would remain a large, man-made structure and the ROS characteristics would not return to pre-mine conditions. The increased access and familiarity of the area for recreation would likely result in long-term displacement of dispersed users in and around the analysis area.

3.15.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

3.15.4.3.1 Short-term Effects During Construction, Operations, and Reclamation Phases

The overall short-term effects of Alternative 3 on recreation would be similar to Alternative 2, except as discussed below. Public motorized and non-motorized access would be restricted to mine and agency personnel in all permit areas.

Noise from the Libby Plant Site may adversely affect recreational use and enjoyment of the Libby Creek Recreational Gold Panning Area (see section 3.19.4, *Environmental Consequences* of the *Sound, Electrical and Magnetic Fields, Radio and TV Effects* section). Visual effects to user experience due to the construction and operation of proposed facilities are described in section 3.16.4, *Environmental Consequences* of the *Scenery* section.

The specific configuration of the Little Cherry Loop Road (NFS road #6212) closure and other road closures within the proposed Poorman Tailings Impoundment Site would be different from Alternative 2, but the effect of the closures (restricting both motorized and non-motorized recreation access) would be the same.

Non-motorized recreation and trail access to the upper Poorman Creek drainage (NFS road #2317/Trail 129) would be retained and improved due to the development of a recreational parking area adjacent to LAD Area 1 along Poorman Creek Road (NFS road #2317). The recreational enjoyment of the Libby Creek Trail (Trail 119), west of the Libby Adit Site, and overall wilderness values in the CMW would be altered in the upper Libby Creek drainage due to noise, traffic, and visual effects associated with the proposed facilities in the Libby Creek drainage. Unlike Alternative 2, non-motorized recreation access would be permitted through the permit area boundary on NFS road #4781/Trail 820 to the upper Ramsey Creek drainage. The improvements to the Bear Creek Road (NFS road #278) would improve recreational access to the area. Because the Bear Creek Road would be plowed in the winter, it would improve winter recreation access to the analysis area (although the existing snowmobile use of the road would be affected).

The development of a scenic overlook along the Bear Creek Road (NFS road #231) east of Howard Lake with interpretive information about the mine would benefit recreation opportunities by providing an additional amenity in the area. Overall recreation effects would be mitigated through funding a campground host from Memorial Day through Labor Day at Howard Lake Campground during the construction and operation phases of the mine.

Channels affected by the Poorman Tailings Impoundment Site are not fish-bearing and do not provide recreational fishing access. Alternative 3 would not affect recreational fishing opportunities.

3.15.4.3.2 Changes to Recreation Setting

The level of mine facility development proposed in Alternative 3 would change the ROS characteristics for the analysis area. The Libby Creek drainage within the analysis area would change in character from Roaded Natural to Rural. As in all action alternatives, the NFS road #278 corridor from U.S. 2 to the impoundment site, and would change to Rural near the impoundment site, LAD Areas, and plant site. These changes from less developed to more developed recreation settings probably would likely displace some recreationists seeking a more remote and dispersed recreation experiences. Estimated changes to ROS characteristics within the analysis area, in acres, are shown in Table 117.

3.15.4.3.3 Long-term Effects After Closure

The long-term effects of the mine operations, after closure and reclamation are complete, would include the elimination of several roads within the tailings impoundment site, including NFS road #6212.

Long-term recreational access to the roads and trails in the Poorman, Ramsey, and Libby Creek drainages would be similar to existing conditions. Roads and trails closed for wildlife mitigation would no longer be used for motorized access. No long-term effects to trail user access or experiences in the CMW, the Howard Lake Campground, and the Libby Creek Recreational Gold Panning Area would occur. The long-term effect on ROS characteristics would be the same as Alternative 2. New recreation amenities, including a recreational parking area along Poorman Creek Road (NFS road #2317) and a scenic overlook along Bear Creek Road (NFS road #231) would result in long-term recreation benefits.

3.15.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

The effects of the plant site, adits, and LAD Areas in Alternative 4 on recreation and recreation setting would be the same as those described under Alternative 3. The effects of the tailings impoundment in Alternative 4 on recreation would be the same as those described under Alternative 2. The long-term effect on ROS characteristics would be the same as Alternative 2. Proposed mitigation (campground enhancement) would be the same as Alternative 3.

3.15.4.5 Alternative A – No Transmission Line

Alternative A would not affect recreation in the analysis area. Access to roads and trails would continue as it is currently. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands.

3.15.4.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

The North Miller Creek Alternative would result in the greatest amount of new access roads (9.9 miles) for the construction and maintenance of the transmission lines (Table 113). These roads would be closed to motorized vehicles. These new roads would benefit non-motorized recreation access (*i.e.*, walk-in hunting and fishing access, hiking, berry picking) on both National Forest System lands and on private lands where public access was permitted.

Alternative B would cross through the Libby Creek Recreational Gold Panning Area for a distance of 1,761 feet, and also would cross Trails 118, 716, and 820 (Figure 79). Transmission line construction would adversely affect the short-term use and enjoyment of these areas due to increased noise, traffic, and construction activity. During mine operation, the existence of the transmission line would alter the scenic integrity and landscape character of trail corridors and the Gold Panning Area. This alteration of scenic integrity and landscape character in these localized areas could result in minor adverse effects on enjoyment of recreational amenities that are crossed by transmission lines.

The ROS characteristics of the transmission line corridor would change from Semi-Primitive Non-Motorized to Semi-Primitive Motorized in the area north of Miller Creek (Table 118). These changes from less developed to more developed recreation settings would likely displace some recreationists seeking a more remote and dispersed recreation experiences. Over the long term, these changes to ROS characteristics would extend about 20 years beyond the time when the transmission lines are decommissioned. As vegetation cover fills in the reclaimed transmission line corridor, the ROS characteristics would change to existing conditions.

3.15.4.7 Alternative C – Modified North Miller Creek Transmission Line Alternative

Alternative C would benefit non-motorized recreation access by providing 3 miles of new access roads on both National Forest System and private lands where public access is permitted (Table 113). These new road corridors would enhance non-motorized recreation access. The length of new roads in Alternative C (and subsequent recreation benefits) would be the least among the transmission line alternatives. Alternative C would cross trails 859, 118, 716, and 820 (Figure 79), as well as the Libby Creek Recreational Gold Panning Area for a distance of 1,754 feet. The adverse effects to trails and the Gold Panning Area would be the same as Alternative B.

The ROS characteristics of the transmission line corridor would change from Semi-Primitive Non-Motorized to Semi-Primitive Motorized in the area north of Miller Creek (Table 118). These changes from less developed to more developed recreation settings would likely displace some recreationists seeking a more remote and dispersed recreation experiences. Over the long term, these changes to ROS characteristics would extend about 20 years beyond the time when the transmission lines are decommissioned. As vegetation cover fills in the reclaimed transmission line corridor, the ROS characteristics would change to existing conditions.

3.15.4.8 Alternative D – Miller Creek Transmission Line Alternative

Alternative D would result in slightly more miles (3.3 miles) of new access roads (and related benefits to non-motorized recreation access) than Alternative C. Alternative D would cross trails 859, 300, and 820 (Figure 79), as well as the Libby Creek Recreational Gold Panning Area for a distance of 2,118 feet. The effects to trails and the Gold Panning Area would be the same as Alternative B. As described in section 3.16, *Scenery*, visual effects to recreationists at Howard Lake would be negligible.

The ROS characteristics of the transmission line corridor would change from Semi-Primitive Non-Motorized to Semi-Primitive Motorized in the area adjacent to upper Miller Creek (Table 118). These changes from less developed to more developed recreation settings would likely displace some recreationists seeking a more remote and dispersed recreation experiences. Over the long term, these changes to ROS characteristics would extend about 20 years beyond the time

when the transmission lines are decommissioned. As vegetation cover fills in the reclaimed transmission line corridor, the ROS characteristics would change to existing conditions.

3.15.4.9 Alternative E – West Fisher Creek Transmission Line Alternative

The length of new access roads in Alternative E (and related benefits to non-motorized recreation access) (3.5 miles) would be greater than Alternatives C and D, but less than Alternative B. Alternative E would cross trails 859 and 820 (Figure 79), as well as the Libby Creek Recreational Gold Panning Area for a distance of 2,118 feet. The effects to trails and the Gold Panning Area would be the same as Alternative B. As described in section 3.16, *Scenery*, visual effects to recreationists at Howard Lake would be negligible. These changes are not anticipated to substantially affect the ROS characteristics (Table 118).

Table 118. Change in Acres of ROS Characteristics within the Analysis Area, Transmission Line Alternatives.

ROS Category	Alternative A – No Trans-mission Line, No Mine (Existing Conditions)	Alternative B – MMC's Proposed Trans-mission Line (North Miller Creek Alternative)	Alternative C – Modified North Miller Creek Trans-mission Line Alternative	Alternative D – Miller Creek Trans-mission Line Alternative	Alternative E – West Fisher Creek Trans-mission Line Alternative
Primitive	0	0 (0)	0 (0)	0 (0)	0 (0)
Semi-Primitive Non-Motorized	4,597	3,066 (-1,531)	3,522 (-1,075)	4,053 (-544)	4,463 (-134)
Semi-Primitive Motorized	1,063	2,593 (+1,531)	2,054 (+991)	1,509 (+447)	1,099 (+36)
Roaded Natural	4,322	4,322 (0)	4,406 (+84)	4,420 +(97)	4,420 +97)
Roaded Modified	4,029	4,029 (0)	4,029 (0)	4,029 (0)	4,029 (0)
Rural	0	0 (0)	0 (0)	0 (0)	0 (0)

Changes from existing conditions are shown in (parentheses).
Total study area is 14,011 acres.
ROS = Recreation Opportunity Spectrum
Source: GIS analysis by ERO Resources Corp. using KNF data.

3.15.4.10 Cumulative Effects

Past actions within the analysis area include the establishment of forest access roads and logging roads and the development of the Howard Lake Campground and Libby Creek Recreation Gold Panning Area. These past actions have resulted in the existing recreation setting described above under section 3.16.3, *Affected Environment*. When considering reasonably foreseeable future actions, the development of the Rock Creek Project likely would have similar effects on recreation access and trails within the CMW as those proposed for the Montanore Project. The increased traffic and noise from both mining operations would diminish the quality of some

recreational experiences within the CMW, primarily near Elephant Peak, Rock Peak, and their associated ridgeline. The proposed Snowshoe Project, which would remove tailings from the Snowshoe Mine Site to the north of the analysis area, could exacerbate these effects to recreation experiences within the CMW. Population increases due to these projects would slightly increase demand for recreational opportunities in the region. Even with this increased demand, an abundance of outdoor recreational opportunities would remain for residents and visitors.

3.15.4.11 Regulatory/Forest Plan Consistency

All of the proposed mine and transmission line alternatives would be consistent with the recreation standards in the KFP. This analysis complies with Executive Order 12962 that mandates disclosure of effects to recreational fishing.

3.15.4.12 Irreversible and Irretrievable Commitments

The recreational experience of some users may be irretrievably affected by the project, due to loss of access to particular areas, increased noise, or visual impacts. These effects, combined with increased knowledge of and access to the general analysis area, would likely displace some dispersed recreation (hunting, hiking, and dispersed camping) to other areas of the forest. Long-term road closures within the tailings impoundment and other areas for grizzly bear mitigation (in Alternative 2) would result in an irretrievable loss of recreational access to those roads. The long-term effect on ROS characteristics at the tailings impoundment site would be irreversible.

3.15.4.13 Short-term Uses and Long-term Productivity

All of the action alternatives would include both short-term and long-term road closures within the permit boundary. Short-term closures would have the greatest effect on recreation access in Alternative 2, which would restrict access to the Ramsey and Poorman creek drainages. Long-term road closures in all of the action alternatives would result in a loss of recreation access to NFS road #6212 and several other spur roads within and adjacent to the tailings impoundment. The long-term effects of the proposed project on recreation access in the analysis area would be small.

The noise and visual effects of the proposed project would be most noticeable during the 16 to 19 years of operations. Noise would return to pre-mine levels when reclamation activities ceased, while visual effects would be reduced over time as revegetation efforts were completed and the forest cover re-established in disturbed areas. Over the long term, the proposed project would not affect the ability of the analysis area to provide a variety of forest recreation opportunities.

3.15.4.14 Unavoidable Adverse Environmental Effects

Alternatives 2, 3, and 4 would restrict access and recreational use along the Little Cherry Creek Loop Road (NFS road #6212), which would be restricted to public motorized and non-motorized access. Alternative 2 would restrict recreational access to the Ramsey Creek and Poorman Creek drainages. In addition, all of the proposed transmission line alternatives would alter the scenic integrity of the Libby Creek Recreational Gold Panning Area, as well as several trail corridors. The proposed mine alternatives would adversely affect some recreational experiences due to noise and visual impacts. These aesthetic impacts would be concentrated in the Ramsey and Libby creek drainages in Alternative 2, the Libby Creek drainage in Alternatives 3 and 4, and along NFS road #278 (Tailings Impoundment Sites) in all mine alternatives. The long-term effect on ROS characteristics at the tailings impoundment site would be unavoidable.

3.16 Scenery

3.16.1 Regulatory Framework

Requirements for environmental protection for operations involving locatable minerals are described in the Forest Services' mineral regulations (36 CFR 228, Subpart A). All operations are required, to the extent practicable, to harmonize operations with scenic values through such measures as the design and location of operating facilities, including roads and other means of access, vegetative screening of operations, and construction of structures and improvements which blend with the landscape (36 CFR 228.8(d)).

Under the current KFP, the KNF uses the USDA Forest Service Visual Management System (VMS) to inventory visual resources and to provide measurable scenery management standards on the KNF (USDA Forest Service 1974). VQOs were determined by the KNF for the entire KNF following an analysis of characteristic landscapes and sensitivity levels. The five VQOs are: Preservation, Retention, Partial Retention, Modification, and Maximum Modification; these terms are defined in the *Glossary*. Development of measurable standards or objectives for the visual management is the purpose of assigning VQOs. Each VQO describes a degree of acceptable alteration of a characteristic landscape based on the importance of aesthetic resources to the users. VQOs are an important part of the KFP because many national forest users and nearby residents value the forest's intrinsic aesthetic resources.

In mine Alternatives 2, 3, and 4, the KNF would amend the KFP by reallocating to MA 31 all areas within the operating permit areas of LAD Areas 1 and 2, and portions of the plant site and tailings impoundment currently not in MA 31. MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*. In addition, a proposed road and facility corridor that would cross MA 13 would be reallocated to MA 31. MA 31 has a VQO of Maximum Modification. Therefore, the applicable VQO for all mine facilities would be Maximum Modification. In transmission line Alternatives B, C, D, and E, the KNF would amend the KFP by reallocating certain areas disturbed by the 230-kV transmission line on National Forest System lands as MA 23. MA 23 has a VQO of Maximum Modification. The MAs that would not be reallocated to MA 23 currently have a VQO of Modification. The applicable VQO for all transmission line alternatives would be Maximum Modification or Modification.

3.16.2 Analysis Area and Methods

3.16.2.1 Analysis Area

The analysis area was determined by the location of the proposed mine facilities, the location of four transmission line alternatives and the visible portions of proposed project facilities that would affect the characteristic landscapes and sensitivity levels of observation points used in visual baseline reports. Changes to characteristic landscapes would include loss of vegetation and landform modifications at and near the proposed facilities, and sensitivity levels would be lowered by the presence of mine facilities not already existing within a given view. Scenery in the analysis area includes the summit and shoulder terrain of the Cabinet Mountains, forested mountains, and valleys adjacent to and east of the Cabinet Mountains; and a 6-mile portion of U.S. 2 east of the Cabinet Mountains (Figure 80).

3.16.2.2 Methods

Several previous visual resource reports and additional analysis were used to describe and assess effects on scenery. A visual baseline report that characterized the visual resources near proposed mine facilities, excluding any transmission line alternatives, was prepared in 2005 (Maxim Technologies 2005). The report assessed the visual effects of the mine facilities using two USDA Forest Service methods for analysis. Both methods were acceptable to the KNF and DEQ, and used KNF user data and observation points from a previous visual resource baseline study (Woodward-Clyde Consultants 1989d). The agencies determined the data to be applicable to most of the current physical conditions and user preferences.

Another report characterized the visual resources and assessed visual impacts of three transmission line alternatives evaluated by MMC (Power Engineers, Inc. 2006b). The report used the same two methods as the Maxim Technologies report to analyze visual impacts.

The current mine and transmission line alternatives were assessed from 11 key observation points (KOP) selected by the KNF and DEQ (Holdeman Landscape Architecture 2006). An alpine characteristic landscape located above timberline in the Cabinet Mountains on Elephant Peak is one of the KOPs. The USDA Forest Service VMS method was used to describe impacts to scenery for the alternatives. The VMS method of analysis directly associated project impacts to applicable VQOs.

Visual analysis of the transmission line alternatives consisted of two viewshed analyses. One viewshed analysis was performed from each of the 11 KOPs. Vegetation was included in the analysis by adding an average tree height to the digital terrain model to accurately determine the length of each transmission line alternative visible from each KOP. Different tree heights were assumed for timber and non-timber harvested areas. Digital polygons were developed to represent the shape of the tree clearing areas required for the lines, structures, and access roads. The digital polygons were "elevated" electronically above the ground to the average tree height. The total length of transmission line alternative visible from each KOP was calculated using GIS. A qualitative analysis is also provided in the EIS regarding the level and type of use of each KOP. The qualitative analysis was developed from field observations and photographic simulations from four of the 11 KOPs (Figure 80).

The second viewshed analysis was performed from the corridor of each transmission line alternative. The same polygons used in the first analysis were used in the second one. This analysis determined the number of KOPs, length of high-use roads, and acres of CMW visible from each transmission line corridor. Roads used in the analysis were NFS roads #4776, #4724, #231, #385, and U.S. 2.

The visibility of the transmission line from the Howard Lake Campground was evaluated in two transmission line alternatives, Miller Creek and West Fisher Creek. These two alternatives would use the same alignment east of the lake and campground. Using digital elevation data, a profile of the ground surface was developed for each transmission line structure near the lake. Trees 75 feet high between the viewer on the west side of the lake and the transmission line were used to determine line visibility. The analysis is on file in the project record.

3.16.3 Affected Environment

The analysis area is characterized visually by the summit peaks of the Cabinet Mountains surrounded by the adjacent densely forested mountains and valleys, with some flat, open creek or stream valleys of dense low-growing herbaceous vegetation interspersed with the forest. The four transmission line alternatives and mine facilities alternatives would be located in montane forest and valley characteristic landscapes within the KNF. Multiple alpine peaks in the Cabinet Mountains are also a significant part of views from most of the key observation points.

3.16.3.1 Characteristic Landscapes

An area's visual character, called characteristic landscape, is based on the area's physical characteristics, such as viewing distance, landform variety, and the presence of man-made forms. Three characteristic landscapes are found in the analysis area: alpine, montane forest, and montane valley. These landscapes are described in the following sections.

3.16.3.1.1 Alpine Characteristic Landscape

The alpine characteristic landscape is defined by a portion of the Cabinet Mountains along a north-south line from Snowshoe Peak to Baree Mountain (about 35 miles long and 7 miles wide), centered along the range's highest peaks; and includes some mountainous areas below timberline known as the Cabinet Shoulders. Mountain summit landforms with dominant vertical and steep slopes above timberline typify the alpine characteristic landscape. Near mountaintops and above timberline, areas of snow are frequently present. The summit topography possesses strong contrasting characteristics with the sky and landforms below.

The mountain slopes below and near timberline support sparse populations of evergreen trees with a ground cover of shrubs and grasses. The forested portion of the alpine characteristic landscape also includes large, mostly bare rock formations, creating many open areas among the trees. This region has the highest elevations (8,738 feet at Snowshoe Peak) in the analysis area.

Although no mine facilities or transmission line alternatives would be located in the alpine characteristic landscape, one KOP is located in this area. Additionally, this characteristic landscape is an important component of the views from most of the other KOPs. This characteristic landscape is the highest quality scenery as defined by the VMS.

The KOP in the alpine characteristic landscape is located on Elephant Peak in the CMW. Views from this location are unobstructed in nearly all directions; are mostly absent of artificial forms; and include a large variety of landforms, rock forms, water forms, colors, and textures. The views from this KOP are representative of most of the Cabinet Mountains peaks and some of the CMW above timberline. Most of the proposed mine facilities, not including the tailings impoundments, and portions of all four transmission line alternatives would be visible from this KOP.

3.16.3.1.2 Montane Forest Characteristic Landscape

Most mine and transmission line alternatives would be located in the montane forest characteristic landscape. Densely forested mountain landforms typify this landscape. Due to the high density and the height of the forest near roads, only a small number of long-distance views exist from roads. Most views along roads are of the forest and restricted to short distances.

The analysis area has few developed recreational facilities; most observation points are from roads, mountains, and hill tops, or at the edge of the forest. An exception is the developed

campground area at Howard Lake, which has a KOP located on the beach next to the lake. Timber harvest areas have created some openings in the forest along roads that provide views of the Cabinet Mountain summits and valleys below. These few locations offer tree-framed views with a large variety of mountainous landforms, vegetation communities, and sky conditions. KOPs 1, 2, 4, and 6 are located in montane forests.

3.16.3.1.3 Montane Valley Characteristic Landscape

Gentle to nearly flat landforms with creeks or streams define the montane valley characteristic landscape, which is interspersed within the montane forest characteristic landscape. Some mine facilities and transmission line alternatives would be located in the montane valley characteristic landscape. Montane valleys include forested areas similar to the adjacent mountains and openings with low-growing herbaceous vegetation and deciduous shrubs and trees concentrated along creeks. Views of the Cabinet Mountain summits are visible from the valleys with low-growing vegetation. Valley areas also include the only buildings visible from KOPs in the analysis area. All of the buildings are residences or associated outbuildings, and most of the residences are located along U.S. 2. Due to the relatively small quantity, very low density, and partial obscurity by low density vegetation, these structures rarely distract from scenic views by travelers and other recreationists.

Some timber harvest areas of the KNF and adjacent private lands are visible from KOPs located in montane valleys. A few timber harvest areas are immediately adjacent to the public roads and are therefore highly visible. Timber harvest areas on mountainsides are typically only partially visible due to the screening effects of vegetation and topography. KOPs 7, 8, 9, 10, and 11 are located in montane valleys.

3.16.3.2 Visual Quality Objectives

Areas currently managed for Partial Retention VQO are located within portions of the analysis area for all proposed facilities. Areas managed for Modification VQO are also located within portions of the analysis area for all proposed facilities. To meet the Modification VQO, management activities may visually dominate the characteristic landscape. With a Modification VQO, activities of vegetation and/or landform alteration must borrow from the existing undisturbed form, line, color, and texture so as to match the surrounding characteristic landscape. Management activities may dominate the characteristic landscape in a Maximum Modification VQO.

3.16.3.3 Concern Levels

Concern levels, from low to high, were established from user survey information for individual observation points to determine the importance of visual resources to the visitors. Concern levels of visitors were identified from visitor use monitoring data collected by the KNF (Kocis *et al.* 2003). The largest groups of visitors to the KNF are local residents from the towns of Libby, Troy, and Eureka. Forest scenery consistently ranked highest in importance for wilderness, developed day use areas, overnight facility users, and some private residences with views of proposed facilities. Concern levels at private residences in the analysis area are high. Views from private residences are typically long-term and often influence specific uses of private properties.

3.16.4 Environmental Consequences

3.16.4.1 Alternative 1 – No Mine

The existing scenery from KOPs would not change in the No Mine Alternative. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. The existing Libby Adit Site would remain, and would be visible only from KOP 4 in a montane forest at a NFS road #231 Pullout (Figure 80). Disturbances on private land at the Libby Adit Site would remain until reclaimed in accordance with existing permits and approvals.

3.16.4.2 Alternative 2 – MMC's Proposed Mine

For all action alternatives, and for the duration of the mine's and transmission line's operation, mine facilities, presence of haul vehicles, and introduction of night lighting at all mine facilities and along NFS roads would alter views from KOPs and other locations. Following mine closure, reclamation of most mine facilities would return disturbed areas to a condition similar to a timber harvested area. The tailings impoundment would not be restored to match any existing condition in the KNF and would result in a permanent change in scenery.

3.16.4.2.1 Libby Adit Site and Rock Lake Ventilation Adit

The Libby Adit Site would alter scenic integrity from the scenic overlook at KOP 2, Elephant Peak (KOP 3), the south NFS road #231 pullout (KOP 4), a portion of NFS roads #231 and #4776, portions of the CMW, and a portion of a private land parcel along Libby Creek northeast of the adit site. (Figure 80). Viewing significance, as defined by the VMS Concern Levels from the three KOPs and two roads would be high due to high visitor use, close proximity to the impoundment, long viewing duration due to stationary viewers or a high viewing angle above the site's location. The visible landscape character would be changed through landform modifications and vegetation pattern interruptions. The change would alter scenic integrity by introducing noticeable contrasts of new buildings, fencing, night lighting, and the presence of mine traffic. The visual absorption level of the Libby Adit Site is high, indicating a substantial capacity to accommodate change. Noticeable changes from KOP 4 would be substantial due to a direct unobstructed line of sight to the adit and long duration views. Only a relatively small portion of the adit site would be visible from the private land parcel due to the screening effects of trees and topography. The Libby Adit Site would meet Maximum Modification VQO criteria.

Following the mine closure, regrading and revegetation would create areas with similar landscape characteristics to the existing timber harvested areas and unpaved, abandoned roads. The adit site would meet all Maximum Modification VQO criteria during construction, operations, and post-closure.

The Rock Lake Ventilation Adit would be an air ventilation opening on the ground, about 15 feet by 15 feet in size, and covered by a metal grate. No mine materials would be transferred to or from this location, and a temporary construction disturbance of less than 1 acre would occur because the adit would be constructed from the mine underground. The adit would be located on the west side of the Cabinet Mountains and, therefore, not visible from 10 of the 11 KOPs. The adit would be very difficult to see from KOP 3, Elephant Peak, because of the site's relatively small size and the screening effects of topography. Views of the adit from Rock Lake would be

partially obscured by topography and timberline vegetation. Because the Rock Lake Ventilation Adit is located on private land, no VQO criteria apply. Following the mine closure, regrading would create an area with similar landscape characteristics to the existing treeless areas at timberline.

3.16.4.2.2 Ramsey Plant Site

Construction and use of the Ramsey Plant Site would alter the scenic integrity from the scenic overlook at KOP 2, Elephant Peak (KOP 3), a portion of NFS roads #231 and #4776C, and portions of the CMW (Figure 80). Viewing significance would be high due to high visitor use along NFS road #4776C and at KOP 2, and the high view angle above the plant site and unobstructed view from Elephant Peak (KOP 11). Although Elephant Peak is 1 mile from the plant site, it receives very low visitor use due to its remote location and non-motorized accessibility. Because the plant site and adit entrances would be located between two vegetated ridges to the north and south, views from the roads would be very short duration and partially obscured by vegetation; views from the CMW would be partially or entirely obstructed by topography and vegetation.

Landscape character would be changed over the short term due to the construction of the plant facilities, specifically to the vegetation pattern and land use. These changes would alter scenic integrity by introducing noticeable contrasts. The visual absorption capability of the plant site is high, indicating a substantial capacity to accommodate change, and the area of disturbance would be relatively small in most views.

Following the mine closure, regrading and revegetation would create areas with similar landscape characteristics to the existing timber harvested areas. The plant site would meet all Maximum Modification VQO criteria during construction, operations, and post-closure.

3.16.4.2.3 LAD Areas

Use of the two LAD Areas would alter the scenic integrity over the short term from the representative viewpoint along NFS road #4776C at KOP 2, the scenic overlook at KOP 3, a portion of NFS roads #231 and #4776, and portions of the CMW (Figure 80). Viewing significance from the two KOPs and two roads is high due to high visitor use and/or close proximity to the LAD Areas. Views from the KOPs are also long duration, while views from the two roads are short duration and partially obscured by vegetation. Viewing significance from the private land parcel east and south of the LAD Areas would be high due to potential long duration viewing times and close viewer proximity to the LAD Areas. The private land parcel north of Bear Creek would not be affected due to the screening effects of trees and topography.

The visible landscape character, such as the landform, vegetation pattern, and land use, would be changed over the short term due to the use of the LAD Areas. These changes would alter scenic integrity by introducing noticeable and significant contrasts. The visual absorption capability of the LAD Areas is high, indicating a substantial capacity to accommodate change. For example, tree clearings would have some similar landscape characteristics to the tree harvested areas in the same vicinity as the LAD Areas.

Following the mine closure, regrading and revegetation of the LAD Areas would potentially create areas with landscape characteristics identical to the existing timber harvested areas. The LAD Areas would meet all Maximum Modification VQO criteria during construction, operations, and post-closure.

3.16.4.2.4 Little Cherry Creek Tailings Impoundment Site

The Little Cherry Creek Tailings Impoundment Site would alter scenic integrity over the short term from KOPs 1, 2, and 3, a portion of NFS roads #231 and #4776, and portions of the CMW. Viewing significance from the three KOPs and two roads is high due to high visitor use, close proximity to the impoundment, long viewing duration, and a high viewing angle above the impoundment site. From KOP 2, the scenic overlook, approximately one-fourth of the impoundment site would be obstructed from view due to the screening effects of topography and vegetation. Although the visual absorption capability of the tailings impoundment location is moderate, its relatively large size in all views would create noticeable contrasts in landscape character, and significant alterations in scenic integrity. A visual simulation of the Little Cherry Creek Tailings Impoundment Site from KOP 2, a representative view from NFS road #4776C, is presented in Appendix I.

KOPs 1, 2, and 3, would have a mostly unobscured direct line of sight and view of a majority of the tailings impoundment. Because each KOP is a destination for scenic viewing, these views are also long in duration. KOPs 1 and 2 receive high visitor use. These two points are easily accessed by all vehicle types and are located relatively close to Libby and U.S. 2. Local residents often bring out-of-town visitors to these KOPs for scenic viewing.

Views of the tailings impoundment from NFS roads #231 and #4776 would be partially obscured by vegetation. Openings in the vegetation also would frame, and emphasize views of the tailings impoundment. Although these views would be mostly from slow-moving vehicles with short-viewing durations, the tailings impoundment would be visible from about 2 miles of NFS road #231, and about 1 mile of NFS road #4776. From NFS road #231 views of the tailings impoundment would be mostly perpendicular to the direction of travel, and from NFS road #4776 views would be directly in line with the direction of travel to the northwest. These two roads are the main vehicular access to KOPs 1 and 2.

Above timberline, dispersed recreational users in some areas of the CMW, would have unobstructed views of the entire tailings impoundment. Views from the CMW below timberline would be similar, but would be partially obscured by vegetation. The landform contrast and relatively large size of the tailings impoundment would create a noticeable interruption of scenic integrity from KOP 3, Elephant Peak, most locations in the CMW east of the major peaks ridgeline, and up to 6 miles away.

Scenic integrity and landscape character from the private land parcel southeast of the impoundment dam, about 0.5 mile (2,700 feet) between dam and nearest property line, would be permanently altered. Scenic integrity would be reduced in northwesterly views from the north end of the private parcel due to a view of the impoundment dam face partially obscured by trees and topography. Scenic integrity would be minimally reduced in northwesterly views from the southern portion of private land due to the increasing screening effects of the forest with increasing distance from the impoundment. The size of the impoundment also would be diminishing with increasing viewing distance.

Scenic integrity and landscape character from the private land parcel north of the impoundment site, about 0.25 mile (1,400 feet) between impoundment site and nearest property line, would not be affected, or affected only nominally. Visibility of the impoundment site, in southerly views only, would be mostly, or completely, obscured by topography and trees.

The visual absorption capability of the tailings impoundment location and surrounding vicinity is moderate, indicating a moderate capacity to accommodate noticeable change. For example, any disturbances of landform, major disruptions of vegetation patterns, or significant changes in land use at the impoundment site would be very noticeable. Following the mine closure, revegetation of the tailings impoundment would restore some color and texture characteristics similar to the adjacent undisturbed vegetation. Because of the large size and contrasting form, the tailings impoundment would remain an interruption of the scenic integrity of the site.

Following the mine closure in the future, revegetation of the tailings impoundment would partially reduce color and texture contrasts between the tailings impoundment and surrounding landscape. The tailings impoundment would meet all Maximum Modification VQO criteria during construction, operations, and post-closure.

3.16.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

3.16.4.3.1 Libby Creek and Rock Lake Adits

Effects on scenery at the Libby Adit Site would be slightly greater than Alternative 2 because of a larger area of contrasts created by the Upper Libby Adit and additional area of disturbance. Although the disturbed area would remain relatively small in the views from KOPs 2 and 3, the roads, and the CMW, the larger size of the contrasts would create a slightly greater visual distraction. Both adit sites would meet all Maximum Modification VQO criteria. Effects on scenic integrity and landscape character due to the Rock Lake Ventilation Adit would be the same as Alternative 2.

3.16.4.3.2 Libby Plant Site

Construction and use of the Libby Plant Site would alter the scenic integrity from KOPs 2, 3, and 4, a portion of NFS roads #231 and #4776C, portions of the CMW, and the private land parcel east of the plant site (Figure 80). The plant site would be located on a ridge between the Libby and Ramsey Creek valleys and would be highly visible. Viewing significance from KOP 2 is high due to high visitor use along NFS road #4776C, the high view angle above the plant site, and an unobstructed view of the entire plant site. Views from KOP 3 and Elephant Peak would have similar characteristics. Views from NFS roads #231 and #4776C would be short duration and partially obscured by vegetation. Views from CMW in the forest also would be partially obstructed by vegetation. Views from CMW above timberline would be completely unobstructed. Only a relatively small portion of the plant site would be visible from the private land parcel due to the screening effects of trees and topography.

The landscape character would change due to the construction of the plant facilities, specifically to the vegetation pattern, landform, and land use. These changes would alter scenic integrity by introducing noticeable contrasts. The visual absorption capability of the plant site is low, indicating a small capacity to accommodate change. Following the mine closure, regrading and revegetation would potentially create areas with similar landscape characteristics to the existing timber harvested areas. The plant site would meet all Maximum Modification VQO criteria during construction, operations, and post-closure.

3.16.4.3.3 LAD Areas

Effects on scenic integrity and landscape character due to the LAD Areas would be similar to Alternative 2. Use of the two LAD Areas would alter the scenic integrity from KOPs 2, 3, and 4, a portion of NFS roads #231 and #4776, portions of the CMW, and the private land parcel due

east of the LAD Areas (Figure 80). Effects and viewing significance from the KOPs, private land parcels, and two roads would be the same as Alternative 2.

Following the mine closure in the future, regrading and revegetation of the LAD Areas would create areas with identical landscape characteristics to the existing timber harvested areas. The LAD Areas would meet all criteria of the Maximum Modification VQO during construction, operations, and post-closure.

3.16.4.3.4 Poorman Tailings Impoundment Site

Effects on scenic integrity and landscape character due to the Poorman Tailings Impoundment Site would be similar to the Little Cherry Creek Tailings Impoundment Site in Alternatives 2 and 4. Because of the impoundment's location, the entire impoundment site would be visible from the scenic overlook at KOP 3. All other scenic integrity, landscape character, and visual absorption capability characteristics would be the same as Alternatives 2 and 4. The tailings impoundment site would meet all applicable Maximum Modification VQO criteria. A visual simulation of the Poorman Tailings Impoundment Site from KOP 2 is presented in Appendix I.

Scenic integrity and landscape character from the private land parcel due east of the impoundment dam, about 0.06 miles (350 feet) between dam and nearest property line, would be permanently and significantly altered. Scenic integrity would be substantially reduced in westerly views from the north end of the private parcel due to a mostly unobstructed view of the 270-foot high impoundment dam face. Scenic integrity would be moderately reduced in northwesterly views from the southern portion of this parcel due to the increasing screening effects of the forest with increasing distance from the impoundment. The size of the impoundment also would be diminishing with increasing viewing distance.

Scenic integrity and landscape character from the private land parcel north of the impoundment site, about 1.1 miles (5,700 feet) between impoundment site and nearest property line, would not be affected, or affected only nominally. Visibility of the impoundment site in southerly views only, would be mostly, or completely, obscured by topography and trees.

Following the mine closure in the future, revegetation of the tailings impoundment would partially reduce color and texture contrasts between the tailings impoundment and surrounding landscape. The tailings impoundment would meet all Maximum Modification VQO criteria during construction, operations, and post-closure.

3.16.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Effects on scenic integrity and landscape character due to the Libby Plant Site, Libby Adit Site, upper Libby Adit Site, Rock Lake Ventilation Adit, and LAD Areas would be the same as for Alternative 3. Effects on scenic integrity and landscape character due to the Little Cherry Creek Tailings Impoundment Site would be the same as for Alternative 2.

3.16.4.5 Alternative A – No Transmission Line

The analysis area's existing scenic integrity and landscape character as viewed from KOPs would not change in Alternative A. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit

evaluation program that do not affect National Forest System lands. The visual effect of the Libby Adit would remain until it was reclaimed in accordance with existing permits and approvals.

3.16.4.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

The segments of the North Miller Creek Alternative visible from key viewing locations are shown on Figure 80. About 2.7 miles of transmission line would be visible from three of the 11 KOPs. All three KOPs with transmission line visibility (KOPs 8, 9, and 11) are located on private land. About 2.7 miles of transmission line would be visible from KOP 8, NFS road #385, and the private residences at KOP 11. Visibility of the transmission line, structures, and tree clearing area would be very low and partially obscured from KOPs 8 and 9 due to the screening effects of topographic changes and trees. Effects to KOPs would be negligible because a relatively small portion of the tops of the transmission line structures would be visible slightly above evergreen treetops, and the visible tops would be a very small size within the views. Additionally, the tops of the structures would only be relatively small portions of views from the KOPs. This alternative would have the longest length of visible transmission line visible from the CMW, but the second lowest from high use roads (Table 120). This alternative would meet all Modification and Maximum Modification VQO criteria.

BPA's Sedlak Park Substation and loop line would be on private land owned by Plum Creek. It would not be subject to Forest Service visual management standards. The substation's perimeter would be illuminated during nighttime hours, and lighting would be directed downward to mitigate light and glare. No residences would have a direct view of the proposed substation location.

3.16.4.7 Alternative C – Modified North Miller Creek Transmission Line Alternative

About 1.0 mile of transmission line would be visible from KOP 8, and less than 0.1 mile of transmission line would be visible from KOP 9. Both KOPs with transmission line visibility are located on private land (Figure 80). Visibility of the transmission line, structures, and tree clearing area would be very low and partially obscured from both KOPs due to the screening effects of topographic changes and trees. Effects to KOPs would be the same as for Alternative B. This alternative would be visible from the fewest KOPs of all transmission line alternatives and the shortest length of high use roads (Table 120). This alternative would meet all Modification and Maximum Modification VQO criteria. The visual effect of BPA's Sedlak Park Substation would be the same as Alternative B.

3.16.4.8 Alternative D – Miller Creek Transmission Line Alternative

About 1.7 miles of transmission line would be visible from three of the 11 KOPs. Although 1.7 miles of transmission line would be visible from KOPs 5, 8, and 9, most of the visible portion of transmission line (Table 119) would be from KOP 8 and NFS road #385. Visibility of the transmission line, structures, and tree clearing area would be very low and partially obscured from the three KOPs due to the screening effects of topographic changes and trees. KOP 5 is located in the KNF, and KOPs 8 and 9 are located on private land (Figure 80). Effects to KOPs would be the same as for Alternative B including KOP 5 at Howard Lake, because of the screening effects of the forest and topography, and the view angle of the transmission line away

from predominant views of the lake. The Miller Creek Alternative would be slightly more visible from high use roads than other transmission line alternatives (Table 120).

Effects to Howard Lake also would be negligible because only a small portion of the pole tops would be visible among the evergreen treetops in views to the northeast. The transmission line would not be visible to the southeast. Most visitors at Howard Lake would not have views of the transmission line clearing or structures. A visual simulation of the transmission line in Alternatives D and E from the west side of Howard Lake is presented in Appendix I. Visual simulations from other KOPs are available in the project record. This alternative would meet all Modification and Maximum Modification VQO criteria. The visual effect of BPA's Sedlak Park Substation would be the same as Alternative B.

3.16.4.9 Alternative E – West Fisher Creek Transmission Line Alternative

About 0.9 mile of transmission line would be visible from KOPs 5, 7, and 8 (Table 119). Visibility of the transmission line, structures, and tree clearing area from these three KOPs would be very low and partially obscured due to the screening effects of topographic changes and trees. KOPs 5 and 7 are located in the KNF, and KOP 8 is located on private land (Figure 80). This alternative would affect views from the same number of KOPs as Alternative D. Effects to Howard Lake would be the same as Alternative D. This alternative would have the least total length of visible transmission line from the CMW (Table 120). It would meet all Modification and Maximum Modification VQO criteria. Similar to Alternative B, effects to KOPs would be negligible because a relatively small portion of the tops of the transmission line structures would be visible slightly above evergreen treetops, and the visible tops would be a very small size within the views. Additionally, the tops of the structures would only be relatively small portions within the views from the KOPs. Also, the visual effect of BPA's Sedlak Park Substation would be the same as Alternative B.

Table 119. Transmission Line Length Visible from KOPs.

KOP	Alternative B – North Miller Creek	Alternative C – Modified North Miller Creek	Alternative D – Miller Creek	Alternative E – West Fisher Creek
1-4	—	—	—	—
5	—	—	0.3	0.3
6	—	—	—	—
7	—	—	—	0.3
8	1.6	1.0	1.4	0.2
9	0.2	<0.1	<0.1	—
10	—	—	—	—
11	0.9	—	—	—
Total	2.7	1.0	1.7	0.9

All units are miles.
— = Not visible from KOP.
KOP = Key Observation Point.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 120. Visibility of Transmission Line from KOPs, Roads, and the CMW.

Location	Alternative B – North Miller Creek	Alternative C – Modified North Miller Creek	Alternative D – Miller Creek	Alternative E – West Fisher Creek
KOPs (number)	3	2	3	3
High use roads (miles)	12.5	11.6	13.4	12.9
CMW (acres)	1,501	1,426	1,233	1,177

KOP = key observation point.
CMW = Cabinet Mountains Wilderness.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Based on all KOP, road, and CMW locations with transmission line visibility, Alternative B would have the greatest length of high transmission line visibility at 3.29 miles, and Alternative C would have the greatest length of transmission line with no visibility at 3.43 miles (Table 121). Alternatives C, D, and E would have similar lengths of high and moderate visibility.

Table 121. Visibility Levels of Transmission Line Alternatives.

Visibility	Alternative B – North Miller Creek	Alternative C – Modified North Miller Creek	Alternative D – Miller Creek	Alternative E – West Fisher Creek
No Visibility	1.90	3.43	2.01	1.84
Low	6.81	5.06	7.67	7.83
Moderate	4.35	3.44	3.40	3.45
High	3.29	1.48	1.04	1.77

All units are in miles.
Source: GIS analysis by ERO Resources Corp.

3.16.4.10 Cumulative Effects

Past actions of timber harvest and road construction have altered the scenic integrity of characteristic landscapes of the analysis area. Roads have created linear features visible throughout the analysis area. Timber harvests have altered the line, color, and texture of the undisturbed landscape. The future construction and operation activities of the Poker Hill Rock Quarry near NFS road #231 would affect the scenic integrity of views from the road. Both the quarry and planned mine facilities would be visible from NFS road #231. Timber harvest associated with the Miller-West Fisher Vegetation Management Project also would affect views from NFS roads #231 and #385.

3.16.4.11 Regulatory/Forest Plan Consistency

All mine and transmission line alternatives would meet all VQO criteria following the KFP amendment in each action alternative. There are no visual regulatory requirements for BPA's Sedlak Park Substation and loop line.

3.16.4.12 Irreversible and Irretrievable Commitments

Landform changes caused by the tailings impoundments would alter the scenery and would be an irreversible commitment of visual resources. Changes in scenery from other mine facilities would be an irretrievable commitment of resources. At the mine closure, disturbed areas would be regraded and revegetated, and all buildings and other constructed facilities would be removed. Reclaimed areas would have noticeably different lines, colors, and textures than the adjacent undisturbed landscape.

3.16.4.13 Short-term Uses and Long-term Productivity

Short-term uses affecting scenery would include construction of all proposed mine facilities and the transmission line. In addition, there would be the short-term effects from the presence of fugitive dust from construction activities, night lighting for construction operations, and vehicle traffic.

Long-term effects on scenery would be loss of vegetation and landform changes at all mine facilities and along the transmission line during the life of the mine. Following mine closure, landscape reclamation at all mine facilities, except the tailings impoundment, would create areas similar in appearance to abandoned roads and timber harvest areas. The tailings impoundment would have physical characteristics significantly contrasting with the surrounding landscape. Therefore, the scenic integrity and landscape character changes at the impoundment site would be noticeable indefinitely.

3.16.4.14 Unavoidable Adverse Environmental Effects

Visual impacts of all action alternatives would be unavoidable. Existing settings and landscapes in the analysis would be altered during mine operation and for several decades following operations.

3.17 Social/Economics

3.17.1 Regulatory Framework

3.17.1.1.1 Forest Plan

The KFP guides all natural resource management activities and establishes management standards for the KNF (USDA Forest Service 1987). The KFP establishes management direction in the form of prescriptions consisting of goals, objectives, standards, and guidelines. Goals provide information on the long-range management intent. The objectives and standards of both the forest as a whole and individual MAs must support the goals. MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*. All activities conducted on the KNF must contribute to the realization of the goals. The goal for mineral development is to "encourage responsible development of mineral resources in a manner that recognizes national and local needs and provides for economically and environmentally sound exploration, extraction, and reclamation." The KFP also establishes a goal of providing a sustained yield of timber volume responsive to market demands and supportive of a stable base of economic growth in the dependent geographic area. Management direction for the analysis area is described in more detail in section 3.14.3.2, *Kootenai National Forest Land Management Plan*.

3.17.1.1.2 Hard Rock Mining Impact Act

The Hard Rock Mining Impact Act is designed to assist local governments in handling financial impacts caused by large-scale mineral development projects. A new mineral development may result in the need for local governments to provide additional services and facilities before mine-related revenues become available. The resulting costs can create a fiscal burden for local taxpayers. The Hard Rock Mining Impact Board (HRMIB) oversees an established process for identifying and mitigating fiscal impacts to local governments through the development of a Hard Rock Mining Impact Plan. Under the Impact Act, each new large-scale hard-rock mineral development in Montana is required to prepare a local government fiscal Impact Plan. In the plan, the developer is to identify and commit to pay all increased capital and net operating costs to local government units that will result from the mineral development.

MMC updated the Impact Plan with the cooperation of the affected local governments (Western Economic Services, LLC 2005) and submitted it to Lincoln County for its review. Lincoln County approved the updated plan in 2007. Because the Montanore Project as currently proposed would change employment projections, MMC submitted an amendment for consideration by the HRMIB. The HRMIB approved the amendment in 2008.

3.17.1.1.3 Major Facility Siting Act

The purposes of the MFSA for the construction of electric transmission lines are to: ensure the protection of the state's environmental resources; ensure the consideration of socioeconomic impacts; provide citizens with an opportunity to participate in facility siting decisions; and establish a coordinated and efficient method for the processing of all authorizations required for regulated facilities. The MFSA directs the DEQ to approve a facility if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impacts considering the state of available technology and the nature and economics of the various alternatives.

3.17.2 Analysis Area and Methods

The socioeconomic analysis area is based on various factors that may influence the location and magnitude of potential socioeconomic impacts. Some of these factors include:

- The location of and access to the ore body and to the proposed permit area
- The likely residence area for people working at the mine (existing residents and/or any in-migrating project employees)
- The rate and magnitude of in-migration (which will be influenced by the availability of a trained or trainable local workforce and a developer-sponsored training program)
- The rate and magnitude of population and employee turnover (including student population turnover in schools, employee turnover at the mine, and employee turnover from existing jobs to employment with the Montanore Project)
- The availability and location of existing housing and potential housing and the capacity and condition of existing local services and facilities
- The people directly/indirectly affected economically by the proposed mining operation (*e.g.*, from wages and taxes)
- The willingness and ability of community residents and local government personnel to deal with change
- The allocation and magnitude of costs associated with in-migration of workers and allocation of tax revenues
- Impacts to Sanders County from removing ore and processing in Lincoln County

Based on these factors, the socioeconomic analysis area for the proposed project is Lincoln County and the Towns of Libby, Troy, and Eureka. Affected jurisdictions in the analysis area include the incorporated municipalities of Libby and Troy as well as the Libby, Troy, and Eureka School Districts (Western Economic Services, LLC 2005).

Economic effects to Sanders County would result primarily from the distribution of metal mines tax revenues to Sanders County. Relevant baseline information in Sanders County is provided in section 3.17.3.7, *Fiscal Conditions* because socioeconomic effects are likely to be limited to direct payments to Sanders County that would be distributed among various county agencies. Other baseline data for Sanders County related to population, housing, income, employment, and quality of life are not provided for because in-migrating mineworkers are not expected to establish residency there, and effects to Sanders County would be negligible (Western Economic Services, LLC 2005). Unless otherwise specified, socioeconomic data contained in this section are based on information provided in the *2005 Socioeconomic Report for the Mines Management Montanore Project* (Western Economic Services, LLC 2006).

3.17.3 Affected Environment

3.17.3.1 Population and Demographics

3.17.3.1.1 Historical Population Trends and Characteristics

Since 1950, Lincoln County has experienced relatively substantial fluctuations in its population. Lincoln County experienced the largest increase in population (44 percent) between 1960 and 1970 due to construction of Libby Dam. Between 1970 and 1980, Lincoln County's population

declined by about 1.7 percent. This decline is attributable to the out-migration of construction workers when Libby Dam was completed. Since 1990, the population recovered, by almost 8 percent, from 17,481 people in 1990 to 18,837 people in 2000 (Table 122). The U.S. Census Bureau's 2004 population estimate of 19,101 people in Lincoln County indicates that the population has grown by only 1.4 percent since 2000 (U.S. Census Bureau 2004).

Table 122. Lincoln County Population Characteristics (1970-2004).

Year	1970	1980	1990	2000	2004
Lincoln County	18,063	17,752	17,481	18,837	19,101
% Change		-1.7	-1.5	7.8	1.4
Libby	3,286	2,748	2,532	2,626	2,653
% Change		-16.4	-7.9	3.7	1
Eureka	1,195	1,119	1,043	1,017	1,023
% Change		-6.4	-6.8	-2.5	0.6
Troy	1,046	1,088	953	957	976
% Change		4.0	-12.4	0.4	2.0
Montana	694,409	786,690	799,065	902,125	926,825
% Change		13.3	1.6	12.9	2.7

Source: Western Economic Services, LLC 2006; U.S. Census Bureau 2006a.

In 2000, the median age for both males and females in Lincoln County was 42 years, compared to 38 years in the state. Lincoln County has seen an unusually high number of persons leaving the county between the ages of 25 to 34; this age bracket declined over 33 percent between 1990 and 2000 due to job losses. Lincoln County has experienced an increase in the number of older residents due to the popularity of second homes in rural mountain communities. From 1990 to 2000, people between the ages of 55 to 64 increased by 55 percent and people 65 or older increased 33.5 percent. These growth rates exceeded state growth rates over the same period, which were 25 percent for ages 55 to 64, and 14 percent for ages 64 and older.

3.17.3.1.2 Major Population Centers

Major population centers in Lincoln County include the towns of Libby, Troy, and Eureka. Libby is the largest town in Lincoln County, with about 15 percent of the population (Table 122). Each town's 2004 population was within 5 percent of 1990 populations. Population trends in Libby are similar to those described for the county. Compared to county and state statistics, Libby also has a higher percentage of its population over 65 years of age (Western Economic Services, LLC 2006).

3.17.3.1.3 Population Projections

The population of the county is projected to increase by 0.7 percent per year, rising from 18,866 people in 2004 to 22,740 people by 2030 (Table 123). Population projections for municipalities within Lincoln County were obtained by applying county population actual and projected growth rates from 1970 to 2030 to the municipalities. The population in Libby is expected to increase by 493 persons from 2,653 people in 2004 to 3,146 people in 2030. Troy's population is expected to increase by 187 people and Eureka's population is expected to increase by 195 people. Much of the projected population growth is attributed to expected increases in retirees and other older, more affluent newcomers.

Table 123. Population Projections for Lincoln County Municipalities and Lincoln County.

Year	Libby	Eureka	Troy	Lincoln County
2010	2,659	1,029	982	19,216
2015	2,731	1,057	1,009	19,738
2020	2,834	1,097	1,047	20,483
2025	2,975	1,152	1,100	21,505
2030	3,146	1,218	1,163	22,740

Source: U.S. Census Bureau 2004; Western Economic Services, LLC 2006.

3.17.3.1.4 Minority and Disabled Populations

Census data for Lincoln County are broken down within Census Tracts to show the distribution of minority, disabled, and low-income groups within the county. Libby is located almost entirely in Census Tract 2. Eureka is part of Census Tract 4 and Troy is part of Census Tract 5 (Table 124). In the 2000 Census, racial minorities comprised 2.1 percent of the total county population. Another 1.9 percent of the County population is comprised of two or more races.

Disability is defined by the Census Bureau as a lasting physical, mental, or emotional condition that makes it difficult for a person to do activities or impedes them from being able to go outside alone or to work (Western Economic Services, LLC 2006). In the 2000 Census, 4,012 people were classified as disabled in Lincoln County, or about 21 percent of the population. This compares to about 0.3 percent of the population statewide. The large numbered of disabled people can be attributed to former vermiculite mine workers from the W.R. Grace Mine that suffer from asbestos related diseases at a rate 40 to 60 times the national average.

3.17.3.2 Employment

Employment conditions for Lincoln County are presented in terms of historical employment trends, current types of employment, and baseline employment projections. Lincoln County's economy has typically centered on natural resource extraction industries such as mining and logging. Mining has historically been a dominant feature of the Lincoln County economy. The Rainey Creek and Fisher River districts, east of Libby, and the Sylvanite and Keystone districts, north of Troy, were productive mining areas prior to the 1940s, and gold, silver, copper, zinc, and lead were extracted from mines throughout Lincoln County. Until 1990 when the W.R. Grace mine was closed, Lincoln County was also the world's largest producer of vermiculite. Mining sector businesses comprised 0.6 percent of all businesses, and about 7.0 percent of all county employment in 1986. While the mining sector in 2003 still comprised 0.6 percent of all businesses in the County, it accounted for only 0.4 percent of the total employed in the county (Western Economic Services, LLC 2006).

Table 124. Population by Race and Ethnicity.

Race	Census Tract 1	Census Tract 2	Census Tract 3	Census Tract 4	Census Tract 5	Total	% Total Population
White	3,317	2,507	3,907	5,217	3,152	18,100	96.1
Black	2	4	3	4	8	21	0.1
AIAN	55	36	37	66	32	226	1.2
Asian	5	16	14	13	11	59	0.3
NHOPI	1	0	1	5	0	7	0.0
Some Other Race	13	14	20	13	14	74	0.4
Two or More Races	75	47	87	65	76	350	1.9
Total	3,468	2,657	4,069	5,383	3,336	18,913	100.0
Hispanic	46	33	68	81	43	271	1.4

AIAN = American Indian or Alaskan Native.
NHOPI = Native Hawaiian and Other Pacific Islander.
Source: Western Economic Services, LLC 2006.

According to the Montana Department of Labor and Industry, lumber and wood products comprised 42.1 percent of all manufacturing establishments and 89.7 percent of all manufacturing employment in 2000 for Lincoln County when Owens & Hurst Lumber, Plum Creek Lumber, and Stimson Lumber Company were the three largest lumber and wood product employers. During 2003, the latest data available, the lumber and wood products industry comprised 43.2 percent of all manufacturing establishments, and employment declined to 72.6 percent of manufacturing employment.

The strength of the lumber and wood products industry has historically been tied to the strength of the national housing and construction market, as well as the local availability of timber. Between 1993 and 2005, five lumber mills closed, leaving only Plum Creek with continuing operations in Lincoln County.

In 2003, the top three employment sectors in Lincoln County were government enterprises, retail trade, and healthcare and social assistance industries. The government enterprises sector, with 17.2 percent of total employment, was the largest single employer in Lincoln County. The retail trade sector was the next largest with 12.1 percent of total employment followed by the healthcare and social assistance sector with 10.2 percent of total employment (Table 125). Overall, the services sector (including trade, general services, utilities, and transportation) accounts for close to half of all employment. Contributing to the services sector is a vibrant recreation industry that provides visitors numerous camping, hiking, skiing, snowmobiling, hunting and fishing, wildlife viewing, and other recreation opportunities.

The top 10 private employers for Lincoln County during the third quarter of 2004, listed in alphabetical order, were Genesis Inc., Harlow's School Bus Service, Libby Care Center, McDonalds (Libby), Mountain View Manor, Owens & Hurst Lumber, Plum Creek Timber, Rosauer's Supermarkets, St John's Lutheran Hospital, and Stein's IGA.

Table 125. Lincoln County Employment Trends (2001 - 2003) for Major Industrial Sectors.

Industrial Sector	2001		2002		2003	
	Persons	%	Persons	%	Persons	%
Services (Trade, Service, Utilities, Transportation)	2,829	32.4	3,938	44.3	3,876	43.1
Finance, Government, Education	1,749	20.0	1,721	19.4	1,801	20.0
Goods Production (Construction/Manufacturing)	1,483	17.0	1,466	16.5	1,274	14.2
Resource Commodity (Agriculture, Mining, Forestry)	981	11.2	1,014	11.4	317 (D)	3.5 (D)
Total Employment	8,742		8,887		8,989	

Employment based on the number of full- and part-time jobs.
Note: (D) = Some data not included to avoid disclosure of confidential information; estimates included in totals.
Source: Western Economic Services, LLC 2006.

The labor force in Lincoln County, defined as persons working or seeking work, declined by 1,742 persons, from 8,501 in 1990 to 6,759 in 2004. This is a decline of 1.62 percent per year compared to an increase of 1.21 percent statewide.

In Lincoln County, the unemployment rate, the number of unemployed persons as a percentage of the labor force, increased from 12.4 percent in 1990 to 12.8 percent in 2004. This was nearly three times more than the unemployment rate of Montana, which was 4.4 percent during 2004.

Total employment in Lincoln County is projected to increase to 12,572 people by 2030. Increases in future employment would likely be attributed to growth in the services sector. This increase represents an annual growth rate of 1.3 percent between 2003 and 2030, higher than the historical 1970-2002 growth rate of 0.5 percent (Western Economic Services, LLC 2006).

3.17.3.3 Income

The median family income in Lincoln County was $31,784 in 2000, about 21.5 percent lower than the state-wide income of $40,487. Real per capita income in Lincoln County has been increasing at a rate of 1.1 percent per year, rising from $13,612 in 1969 to $19,832 in 2003. This compares to an annual growth rate of 1.9 percent real per capita income statewide. Lincoln County's average wage of $24,853 in 2003 was lower than the statewide average of $29,281. The top-paying sectors of the economy included the government ($44,135), manufacturing ($38,755), and information ($33,156).

Low-income concentration was estimated by taking into consideration all families that had 50 percent or less of the county's median family income. Families making less than $15,000 in each Census Tract in the county were considered low income. A total of 998 families, or 18.4 percent of the families countywide, had incomes below $15,000. Census Tract 5, which includes Troy, had the highest concentration with 24.4 percent of low-income families in the county. By comparison, families with incomes of less than $15,000 statewide comprised about 12 percent of the total (U.S. Census Bureau 2006b).

3.17.3.4 Economic Activities that Rely on Natural Resources

The following sections briefly describe economic activities in the study area that rely on natural resources such as recreation, logging, mineral exploration, and agriculture. The *Logging*, *Mineral Exploration*, and *Agriculture* sections discuss relevant activities near the analysis area, and are not discussed for all of Lincoln County. For additional information on these activities, please refer to sections 3.14, *Land Use* and 3.15, *Recreation*.

3.17.3.4.1 Recreation

National Forest System lands make up a large percentage of the Lincoln County land base, and offer public access for a variety of motorized and non-motorized recreational activities including: hunting for big game and upland game birds, fishing, hiking, wildlife observation, berry picking, photography, backpacking, horseback riding, snowmobiling, mountain biking, picnicking, sightseeing, OHV use, rock hounding, and camping. Recreational use on the KNF in 2002 was an estimated 1.1 million visits ±15.4 percent (USDA Forest Service 2003b).

Visitor use surveys indicate that KNF is a primary destination for many visitors to northwest Montana. About 25 percent of the 1,302 visitors interviewed were asked about the primary destination of their recreational trip. Of the 17 percent of visitors that also went to areas other than KNF, 89 percent said KNF was still their primary destination. In a typical year, visitors to KNF spent an average of $2,024 on all outdoor recreation activities including equipment, recreation trips, memberships, and licenses (USDA Forest Service 2003b).

3.17.3.4.2 Logging

The National Forest System lands of the Libby Ranger District provide about 6 to 8 million board feet (mmbf) of timber annually. No KNF timber sales are currently under contract in the land use analysis area as of May 2008. As discussed in section 3.3, *Reasonably Foreseeable Future Actions*, the KNF is currently considering the Miller-West Fisher Vegetation Management Project in the land use analysis area. Timber harvest activity also occurs on private, forest-industry lands. The amount of timber harvested has declined in the past 10 years. Small-scale timber harvests occur in the range of 2 to 6 mmbf annually on the private lands in the land use analysis area (Edwards, pers. comm. 2005). Logging has taken place along Libby Creek on public lands since the late 1960s. Timber was harvested from upper Libby Creek and Ramsey Creek following the Libby Creek Road extension in the mid-1970s, resulting in a number of clear-cut areas within the analysis area. Logging continues in the area, with new harvests in lower Ramsey Creek, upper Midas Creek, and much of Miller Creek. The Plum Creek Timber Company has clear-cut harvested several tracts of private land on lower Miller Creek and along the Fisher River (Power Engineers, Inc. 2005c).

3.17.3.4.3 Mineral Exploration

Some mineral activity occurs near the proposed mine. This activity includes small placer operations on Libby and Big Cherry creeks, small lode mining operations along Libby Creek, Snowshoe Creek, at the headwaters of the West Fisher Creek, and in the Prospect Hill area 4 miles south of Libby. A number of mineral operators do some form of work along the east face of the Cabinet Mountains each year (Power Engineers, Inc. 2005c).

3.17.3.4.4 Agriculture

No prime and unique farmland was identified near the proposed mining facilities; some land along U.S. 2 is used for hay and grazing. In addition, no land is enrolled in the Conservation

Reserve Program and no grazing allotments are present on nearby National Forest System lands (Power Engineers, Inc. 2005c). Four commercial apiaries are located near the proposed mining facilities. Commercial apiaries are used for honey production and/or pollination.

3.17.3.5 Housing

In 2000, the U.S. Census Bureau reported that Lincoln County had 9,319 year-round housing units and that Sanders County had 5,271 year round housing units. This was an increase of 16.5 percent in available housing in Lincoln County and 21.6 percent in Sanders County since 1990. Overall, the percent of owner-occupied housing units in both counties (about 76 percent) was higher than the state's 69 percent in 2000.

3.17.3.6 Public Services and Infrastructure

3.17.3.6.1 Schools

Eight elementary schools, three middle schools, and three high schools are located in Lincoln County. Troy Public Schools, Libby K-12 Schools, and Eureka Public Schools have an elementary, middle, and high school each. Fortine, McCormick, Sylvanite, Yaak and Trego have an elementary and middle school each. Total school enrollment for public schools in Lincoln County declined by 3.9 percent between 2001 and 2004.

3.17.3.6.2 Law Enforcement

Law enforcement services in the Lincoln County study area are provided by the Lincoln County Sheriff's Office, the Montana Highway Patrol, the Eureka Police Department, the Troy Police Department, and the Libby Police Department. Thirty full-time law enforcement officers were employed in Lincoln County in 2003. Two jail facilities occur within the study area: a 24-cell adult jail in Libby and a 4-bed juvenile holding facility in Troy.

3.17.3.6.3 Fire Protection

Fire protection in Lincoln County is provided by nine fire departments. The rural/city Libby Fire Department has two fire marshals and 28 volunteers, and the Troy rural/city Fire Department has 25 volunteers. The Montana Department of Natural Resources and Conservation and the Forest Service are responsible for fire protection in lands under their jurisdictions.

3.17.3.6.4 Health Care Facilities

Lincoln County has two healthcare centers: Prompt Care, a rural health clinic in Eureka, and Lincoln Community Health Services in Libby. Lincoln County's healthcare facilities also include the St. John's Lutheran Hospital, a critical access hospital in Libby. This not-for-profit 25-bed medical facility offers 24-hour emergency care services. The Troy area medical facilities include the Medicine Tree Primary Care and the Troy Medical Arts Complex. Lincoln County is served by 15 licensed physicians, six nursing practitioners, three physician's assistants, eight dentists, and seven dental hygienists.

3.17.3.6.5 Water Supply

More than 50 percent of the households in Lincoln County use private wells for their water supply. About 4,750 households in Libby, 1,000 households in Troy, and 1,100 households in Eureka are served by a municipal water system. Libby obtains its water from Flower Creek. Troy receives its municipal water supply from two wells and O'Brien Creek.

3.17.3.6.6 Wastewater Treatment

Libby has operated a public wastewater treatment facility since 1964, and converted from a primary to a secondary treatment facility (*i.e.*, an activated sludge oxidation ditch system) in 1985. In Troy, sewer service is obtained for a fee of $34.27 for residential and $38.97 for commercial service.

3.17.3.6.7 Utilities

Residential telephone service in the Lincoln County study area is provided by Frontier, a subsidiary of Citizens Communications. The long distance service is provided by AT&T. Electric service for Libby is provided by Flathead Electric Cooperative. Lincoln Electric Cooperative is an electric distribution cooperative headquartered in Eureka, providing electricity service to northeast Lincoln County. Northern Energy provides propane to the local area. Northern Lights, Inc. is the electricity provider in the Troy area. Heating sources in the analysis area include fuel, oil, propane, wood, and electricity.

3.17.3.7 Fiscal Conditions

The proposed project would affect the public budgets of Lincoln and Sanders counties, Libby, Troy, Eureka, and those cities' school districts. Basic descriptions of key budget areas for each of these jurisdictions are presented in the following sections.

3.17.3.7.1 Lincoln County

Total taxable property valuation in Lincoln County declined from $30.5 million in fiscal year (FY) 1992 to $25.2 million in FY 2004. This amounts to a decline of $5.3 million, or 1.6 percent per year, with no accompanying decrease in population. While taxable valuation in Lincoln County has declined, county levies increased from 49.48 mills in FY 1992 to 87.13 mills in FY 2004.

Total revenues in Lincoln County increased at a rate of 4.0 percent per year, from $10.23 million in FY 1996 to $13.5 million in FY 2003. The major source of revenue to Lincoln County government was intergovernmental revenues, at 47 percent of all revenues to the county during FY 2003. Total county expenditures also increased at a rate of 5.2 percent per year between FY 1996 and FY 2003, from $9.1 million in FY 1996 to $12.9 million during FY 2003. In FY 2003, 21 percent of the budget was spent on general government, 19.3 percent on public safety, and 33.6 percent on public works. Road maintenance costs are classified under public works expenditures. Lincoln County expenses on road maintenance declined from $2.79 million in FY 1996 to $2.46 million in FY 2003. Road maintenance costs comprised 73.2 percent of the total budgeted expenditure on public works in FY 1996. While road maintenance costs appear to have declined by FY 2003, they still represent 56.6 percent of the total budgeted expenditure on public works.

3.17.3.7.2 Municipalities

Taxable valuation for Libby declined from $3.6 million in FY 1992 to $2.5 million by FY 2004, representing a 1.8 percent decline per year in the tax base. Total revenues for Libby increased from $1.91 million in FY 1996 to $2.54 million in FY 2003. Total expenditures for Libby also increased from $1.92 million in FY 1996 to $3.67 million in FY 2003. About 45 percent of the budgeted expenditure during FY 2003 was spent on public works, which includes road maintenance costs.

Taxable valuation in Troy increased from $679,000 in FY 1992 to $699,000 in FY 2004, an increase of 0.2 percent per year. Total revenues for Troy from taxes average from $76,000 to $79,000 per year. Expenditures for general government in Troy usually require about 40 percent of the budget, and expenditures for public safety also require about 40 percent of the budget.

Total revenues for Troy increased from $1.28 million in FY 1996 to $1.53 million in FY 2003. The major source of revenue to the city during FY 2003 was from charges for services, about 76 percent. Total expenditures for Troy also increased from $1.79 million in FY 1996 to $2.02 million in FY 2003. About 81 percent of the budgeted expenditure during FY 2003 was spent on public works, which include road maintenance costs. Taxable valuation in Eureka increased from $878,000 in FY 1992 to $923,000 in FY 2004, an increase of 0.4 percent per year. Total revenues for Eureka increased from $690,800 in FY 2002 to $835,000 in FY 2003. Total expenditures for Eureka also increased, from $606,500 in FY 1996 to $783,400 in FY 2003.

3.17.3.7.3 School Districts

The taxable valuation for all school districts in Lincoln County decreased at a rate of 1.9 percent per year, from $32.35 million in FY 1991 to $25.36 million in FY 2004. Countywide mill levies to support schools have remained at about the same level since 1991. Taxable valuation for Troy Public Schools experienced a sharper decline compared to the County. Taxable valuation for the elementary school declined by 4.8 percent per year, from $7.47 million in 1991 to $3.77 million in 2004. High school valuation declined 3.5 percent per year, from $8.26 million in 1991 to $5.0 million in 2004. Taxable valuation for Libby K-12 Public Schools experienced a decline of 2.9 percent per year, from $17.5 million in 1991 to $11.5 million in 2004.

Contrary to the county tax base, taxable valuation for Eureka Public Schools experienced an annual increase of 2.9 percent for the elementary school, and 2.1 percent for the high school. Taxable valuation for the elementary school increased from $4.37 million in FY 1991 to $6.53 million in 2004. High school valuation increased from $6.62 million in FY 1991 to $8.85 million in 2004.

Taxable valuation for Fortine Elementary School experienced a decline of 0.2 percent per year, from $1.3 million in 1991 to $1.25 million in FY 2004. Taxable valuation for McCormick Elementary School experienced an increase of 0.7 percent per year, from $347,147 in FY 1991 to $383,702 in FY 2004. Taxable valuation for Sylvanite Elementary School experienced an increase of 4.1 percent per year, from $174,791 in FY 1991 to $305,835 in FY 2004. Taxable valuation for Yaak Elementary School experienced an increase of 5.2 percent per year, from $266,573 in FY 1991 to $540,676 in 2004.

3.17.3.7.4 Sanders County

Total taxable valuation in Sanders County increased slightly, from $24.13 million in FY 1992 to $26 million in FY 2004. This is an increase of $1.9 million, or 0.6 percent per year. The major component of the tax base in Sanders County during FY 2004 was land and improvements, which comprised about 40 percent of the total taxable valuation. Countywide levies also increased, from 66.59 mills in FY 1992 to 106.83 mills in FY 2004. This increase is primarily due to mills levied for the improvement of the town of Paradise.

Total revenues in Sanders County increased from $5.53 million in FY 1996 to $6.54 million in FY 2003. The major source of revenue to Sanders County government has been from taxes and assessments, which increased at the rate of 6.2 percent per year between FY 1996 and FY 2003.

Total county expenditures in Sanders County also increased, from $3.94 million in FY 1996 to $6.45 million in FY 2003.

3.17.3.8 Quality of Life and Lifestyle

Social structure and interaction in Lincoln County have been shaped primarily by geographic isolation, migration, and settlement; a resource-extractive economy; extra-local influence on the economy; and a cyclical economy. A cultural overview for the analysis area is provided in section 3.7, *Cultural Resources*.

Geographic isolation and, consequently, social isolation have a homogenizing effect on the population because communities and interaction are directed to one's own group or community. As a result, similar values and social views develop among individuals and social bonds form, leading to a collective view of and commitment to the community.

Libby area residents have adapted to the cyclic nature of the economy by living off the land (*i.e.*, hunting, fishing, gardening, firewood gathering, and berry picking). Local residents tend to acquire vehicles, homes, and other possessions that are functional rather than ostentatious (Western Economic Services, LLC 2006). Residents of Lincoln County, because of their livelihoods, are closely linked to the natural environment, and have a conservation ethic. Residents do not favor preservation that would prohibit development of natural resources, but rather promoting stability through healthy local economies, lifestyles, and use of natural resources in a sustainable fashion.

A quality of life survey conducted with Lincoln County residents indicates that residents highly value the natural environment and rural, small town atmosphere of the area (Western Economic Services, LLC 2006). Limited economic opportunities were cited as the largest drawback of the area, although residents feel positive about the county as a place to live.

Community services are generally viewed as average, with the exception of fire protection and rescue, which is rated above average. Day-to-day shopping varies from Libby, to Kalispell, Missoula, or other avenues such as catalogues and the internet, and respondents cite the limited selection of goods as a drawback to local businesses. Shopping for major purchases is generally done in Libby, Spokane, or Missoula.

Social problems in the area reported by survey respondents include drug and alcohol abuse, family problems or domestic abuse, poverty, and unemployment. Alcoholism and drug abuse were cited most frequently by about half of the respondents. Libby is also now in the midst of addressing hundreds of deaths and illnesses linked to former vermiculite mining operations.

In the 1920s, mining of a large vermiculite deposit north of Libby began. W.R. Grace owned and operated a vermiculite mine and vermiculite processing facilities in Libby from 1963 to 1990. The vermiculite deposits in Libby were contaminated with a form of asbestos similar to tremolite. Asbestos is regulated under the Clean Air Act as a hazardous air pollutant. Studies have shown that exposure to asbestos can cause life-threatening diseases, including asbestosis, lung cancer and mesothelioma. Mining and processing activities resulted in the spread of vermiculite – and the associated asbestos fibers – to numerous homes, businesses, and schools throughout the town. Health studies on residents of the Libby area show increased incidence of many types of asbestos-related disease, including a rate of lung cancer that is 30 percent higher than expected when compared with rates in other areas of Montana and the United States. The health problems

resulting from the vermiculite mine have resulted in premature deaths, increased health costs, and social division in the Libby area.

The analysis area, like much of the Intermountain West, has seen an increase in rural residences. Many of these rural residences are second homes. The census does not count second-home owners as part of a community's population, thus the impacts of second homes are not readily apparent from changes in population. These second homes can have an impact on local government finances and quality of life issues.

3.17.4 Environmental Consequences

The socioeconomic effects for the No Action Alternatives and the action alternatives were evaluated. The impacts for all of the action alternatives would be the same, so the discussion of Alternatives 2 through 4 and the all the transmission line alternatives was combined.

3.17.4.1 Alternative 1 – No Mine and Alternative A – No Transmission Line

In the No Action alternatives for the mine and the transmission line, the proposed mine and transmission line and substation would not be developed, and existing patterns and trends described in section 3.17.3, *Affected Environment* would continue to drive the social structure and economy of the area. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Economic effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

3.17.4.1.1 Employment and Income Effects

Lincoln County total employment is projected to increase to 12,572 people by 2030. Increases in future employment likely would be attributed to growth in the services sector. This increase would be an annual growth rate of 1.3 percent between 2003 and 2030 (Western Economic Services, LLC 2006).

During 2003, the average wage for all workers in Lincoln County was $408 per week, which was about 21.2 percent lower than the average wages of workers statewide. Within industry groups, the average wage in Lincoln County is less than the state average for corresponding groups, except for jobs in the agriculture, forestry and fishing, manufacturing, and educational service sectors. The highest paying jobs in Lincoln County are manufacturing jobs, which paid over 2.3 percent more than the average statewide in 2003 (Western Economic Services, LLC 2006).

3.17.4.1.2 Population Effects

Lincoln County population is projected to increase by 0.7 percent per year, rising from 18,866 people in 2004 to 22,740 people by 2030. The population in Libby is expected to increase by 493 persons from 2,653 people in 2004 to 3,146 people in 2030. Troy's population is expected to increase by 187 people and Eureka's population is expected to increase by 195 people. Much of the projected population growth is attributed to expected increases in retirees and other older, more affluent newcomers. Total school enrollment for public schools in Lincoln County declined by 3.9 percent between 2001 and 2004. This decline in enrollment is projected to continue at a rate of 1.6 percent annually between 2004 and 2010 (Western Economic Services, LLC 2006).

The in-migration of retired persons to the area (expected to accelerate as the Baby Boom generation begins to retire), combined with in-migration of persons whose employment allows them to live where they choose, is expected to be the most important factor underlying social and economic developments in the region over the next 25 years. Lincoln County is expected to see minimal impact from any larger regional pattern and to continue its slow pace of growth and change. What growth it does see would likely come from the finance, education, government, and service sectors of the economy.

3.17.4.1.3 Community Effects

Existing patterns of development for communities within Lincoln County may be altered as the land use implications of population growth associated with retirement, amenity, and recreation/tourism development are integrated into these communities. Based on the experience of areas like Montana's Bitterroot and Flathead valleys, community development of recreation/tourism based economies can be more dispersed outside of established communities. Lands in private ownership that have supported timber or agricultural production and provided open space are converted to residential subdivisions and ranchettes. During the transition, land use conflicts often arise from the incompatibilities between timber or agricultural production activities and residential use. In some areas domestic water supply and waste treatment pose significant problems. The severity of the problems associated with these land use changes would depend mostly on their pace and extent. Overall, Lincoln County is expected to continue its slow pace of growth and change, and with minimal impact from the larger regional pattern on land use and housing.

3.17.4.1.4 Public Services

Based on existing trends and emerging demographic characteristics for the study area, Lincoln County is expected to experience a substantial reduction in school-age population and enrollment paired with a dramatic increase in the retirement-age sector. This pattern has particular implications for community services. It reduces demand for school facilities and services, but it also produces a voting population that may not be supportive of tax measures needed to maintain existing facilities and cover operating costs. An aging population has fewer people likely to be involved in criminal activity, but a high proportion that may become crime victims. It also is a population that has a high need for medical and emergency response services and community transportation.

3.17.4.2 All Action Alternatives – Includes Transmission Line

3.17.4.2.1 Employment and Income Effects

The U.S. Forest Service produced an analysis of potential employment and labor income effects from the proposed Montanore Project (termed the "Forest Service Effects Analysis" in this section) (USDA Forest Service 2007c) for use in this EIS. The Forest Service Effects Analysis describes potential employment and labor income estimates of the proposed project during specific years within the four project phases:

- Construction phase at Year 3 of the proposed project (peak employment during the construction phase)
- Production phase at project Years 4 through 19
- Post-mining closure phase at Years 20 through 22

- Reclamation and monitoring phase at Years 23 through 42

Project employment and income and the duration of the mine-life phases could vary from projections, depending upon construction progress and the resources applied by MMC toward full-scale operations. Mineral and input market conditions also could cause operations to be curtailed or shut down on short notice at any point during projected mine life.

Employment and income impacts were estimated in the Forest Service Effects Analysis using input-output analysis. Input-output analysis is a means of examining relationships within an economy between businesses, and between businesses and final consumers. Three types of economic impacts (effects) are identified in the analysis: direct, indirect, and induced. Direct effects are production changes associated with the immediate effects of changes in expenditure tied to mine construction, production, post-mining closure, and reclamation and monitoring. Indirect effects are production changes resulting from spending in all phases of operations in industries that supply products and services to construction, production, mine closure, and reclamation and monitoring. Induced effects are changes in economic activity resulting from households spending income earned directly or indirectly as a result of all phases of the proposed project. The sum of indirect and induced effects are referred to as secondary effects, which is the term used in the remainder of the discussion.

Other specific information on the methodological approach and assumptions used in the analysis presented below can be found within the Forest Service Effects Analysis report. Projected employment and labor income effects identified in the Forest Service Effects Analysis are presented below.

3.17.4.2.2 Construction and Production Employment and Income Effects

The estimated total employment during the construction phase of the proposed project would be 581 jobs at Year 3 (Table 126). About 21 percent of the direct employment would be construction related and the remainder attributable to production. The input-output model estimated that there would be about 270 secondary jobs associated with the estimated 310 direct jobs.

Employment during the production phase would vary with the production rate (Table 126). For production Years 4 through 8, total employment would vary from about 500 jobs in Year 4 to about 400 jobs in Years 5 through 8. Fewer employees are needed during the production phase than for the construction phase. Secondary employment would account for about 190 jobs in Year 4 and would drop to about 150 jobs during Years 5 through 8. In Year 9, the production rate is expected to increase from 12,500 tons per day to 17,000 tons per day. Direct mine employment would increase from 246 jobs to 450 jobs during this production increase. Secondary employment also would increase from about 150 jobs to 260 jobs. At Year 14, production is expected to increase from 17,000 tons per day to 20,000 tons per day. During this production increase, direct employment would remain at 450 jobs and secondary employment would increase slightly.

Table 126. Construction and Production Employment Estimates.

Category	Construction Phase	Production Phase			
Project Year	3	4	5-8	9-13	14-19
Production rate (tons per day)	0	12,500	12,500	17,000	20,000
Employment					
Construction (direct)	65[†]	65[†]	0	0	0
Operations (direct)	246	246	246	450	450
Secondary employment	270	188	149	263	268
Total construction and operations	581	499	395	713	718

[†] Includes estimated 23-person crew required for construction of the 230-kV transmission line.
Source: MMC 2008.

At Year 3 of the proposed project, direct labor income would be about $15.9 million and total income would be $22.2 million (Table 127). About 23 percent of the direct labor income would be construction related and the remainder is attributable to production. The 23-person crew required for construction of the 230-kV transmission line would account for about 35 percent or $1.3 million of the direct labor income for construction in each of the Years 3 and 4. Estimated total labor income would range from a low of $16.1 million in project Years 5 through 8 to a peak of $29.2 million in Years 14 through 19 during the production phase. The increased labor income would correspond to the expansion in mine production. In general, with the exception of Years 5 through 8, estimated total labor income would exceed $20 million. On a per-job basis, direct annual labor income for construction and operations employment would average about $57,000 and $50,000, respectively. Annual labor income for secondary employment would be about $26,000 per job.

Table 127. Construction and Production Labor Income Estimates.

Category	Peak Construction Phase	Production Phase			
Project Year	3	4	5-8	9-13	14-19
Production rate (tpd)	0	12,500	12,500	17,000	20,000
Labor Income					
Construction (direct)	$3.7	$3.7	$0.0	$0.0	$0.0
Operations (direct)	$12.2	$12.2	$12.2	$22.3	$22.3
Secondary labor income	$6.3	$4.7	$3.9	$6.5	$6.9
Total construction and operations income	$22.2	$20.6	$16.1	$28.8	$29.2

Income shown in 2003 Million $. Actual totals may differ from values shown due to rounding.

3.17.4.2.3 Post-mining Closure, and Reclamation and Monitoring Employment and Income Effects

MMC expects the post-mining closure phase of the proposed project to last about 3 years. Total employment would be about 200 jobs for the first 2 years and would decline to about 125 jobs in the third year (Table 128). Secondary employment would account for about 40 percent of the total employment during the post-mining closure phase.

The reclamation and monitoring phase of the proposed project would follow the post-mining phase and last about 20 years. This phase also would include consolidation of the tailings and placement of the final cover on the tailings impoundment described in section 2.4.3.1.6, *Tailings Impoundment and Borrow Areas*. Total employment (about 80 jobs) would peak in the first 2 years of this phase and decline to about 30 jobs thereafter. Secondary employment would account for about 38 percent of the total employment during this phase of the proposed project. The second phase would consist on longer-term maintenance of specific facilities, such as the Libby Adit Water Treatment Plant or the seepage collection facilities at the tailings impoundment. MMC would maintain and operate these facilities until water quality standards in all receiving waters could be met by any project discharge. MMC also would continue monitoring as long as the MPDES permit is in effect. As long as post-closure water treatment operates, the agencies would require a bond for the operation and maintenance of the water treatment plant. Human activity associated with facility maintenance and monitoring is expected to be limited, and indistinguishable from current recreational use. The length of time that the second phase of closure activities would occur is not known, but may be decades or more.

Table 128. Post-mining and Reclamation Employment Estimates.

Category	Post-mining Closure Phase			Reclamation and Monitoring Phase		
Project Year	20	21	22	23	24	25-42
Employment						
Contractors (direct)	0	75	50	25†	25†	10
Company workforce (direct)	125	50	25	25	25	10
Secondary employment	76	86	52	31	31	12
Total contractors and company	201	211	127	81	81	32

† Includes estimated 23-person crew required for removal of the 230-kV transmission line.
Source: MMC 2008.

Table 129 displays labor income in 2003 dollars for the post-mining closure, and reclamation and monitoring phases of the proposed project. Direct labor income was based on a workforce consisting of operations, technical, administrative, and environmental services skills. Total labor income during the post-mining phase of the proposed project would be about $7.6 million for each of the first 2 years and would decline to about $4.6 million in the third year. Secondary labor income accounts for about 20 percent of the total labor income during the post-mining closure phase.

Total labor income (about $2.9 million) would peak in the first 2 years of the reclamation and monitoring phase, and would decline to about $1.2 million thereafter. The 23-person crew required for removal of the 230-kV transmission line would account for about 92 percent or $1.1 million of the total labor income for direct contractors in each of the first 2 years of the reclamation and monitoring phase. Secondary labor income accounts for about 16 percent of the total labor income during this phase of the proposed project.

Table 129. Post-mining and Reclamation Labor Income Estimates.

Category	Post-mining Closure Phase			Reclamation and Monitoring Phase		
Project Year	20	21	22	23	24	25-42
Labor Income						
Contractors (direct)	$0.0	$3.9	$2.6	$1.2	$1.2	$0.5
Company workforce (direct)	$6.2	$2.5	$1.2	$1.2	$1.2	$0.5
Secondary labor income	$1.3	$1.4	$0.8	$0.5	$0.5	$0.2
Total contractors and company income	$7.5	$7.8	$4.6	$2.9	$2.9	$1.2

Income shown in 2003 Million $. Actual totals may differ from values shown due to rounding.

The mine would become one of the largest single employers in the area, so any changes in operation or production would impact employment levels. Once the local economy had adjusted to a particular operating level, any reductions-in-force would release individuals whose life style would be attuned to mine wage rates and who would find very few opportunities for comparable employment in the local market. Any shutdown of operations for a few weeks or months would cause a sudden drop in local area income while laid off workers, expecting a resumption of operations, would be unlikely to seek other work. While the affected communities, government jurisdictions, and businesses can plan for mine closure, effects of closure after the planned 20-year production period would result in a drop in employment earnings. Unless other large mining projects are operating in the area at the time, closure of the Montanore mine would eliminate many of the resource commodity sector jobs expected to exist in the local area economy in 2030.

3.17.4.2.4 Population Effects

The employment and income effects analysis summarized above assumes that all employment demand would be met from the Lincoln County labor supply. This assumption could occur if a large local population, or a high rate of unemployment in the relevant skill sets, provided a large pool of available labor. Lincoln County does have a higher than average unemployment rate in comparison to neighboring counties and the state as a whole, but given the number of workers needed and the specialized skills required for the construction and production phases of the proposed project, not all employment demand would be met by Lincoln County residents. Thus, some mine workers would move to the area or commute from locations outside of Lincoln County.

Recent experience for large projects indicates that mining and construction workers will tolerate one-way commuting times of about one hour. Beyond that distance, workers may be more likely to relocate closer to the project site (USDA Forest Service and DEQ 2001). For the Montanore Project, this implies a local employment area that could include all of Lincoln County including the towns of Libby, Troy, and Eureka. If non-local workers (*e.g.*, residents outside of Lincoln County) were to move into Lincoln County for project-related jobs, population within Lincoln County would increase.

Since the proposed Montanore Project is classified as a "large-scale mineral development," according to the requirements in the Montana Hard-Rock Mining Impact Act, the project proponent is required to evaluate potential impacts to affected local government units as a result of in-migrating workers and their families and prepare a Hard-Rock Mining Impact Plan (Impact Plan). The Impact Plan for the Montanore Project was prepared in 2005 and approved by Lincoln County in 2007. The Impact Plan estimates the number of in-migrating direct and secondary workers and their family members associated with the project. Table 130 shows the total number of estimated in-migrants and Lincoln County population increase for project Years 1-5, covering the three-year construction period and the first two years of production. In-migration is expected to peak in the fourth year of the project at the beginning of the production phase and level off for the rest of the production years.

Table 130. Population In-migration Estimates.

Category	Construction Phase			Production Phase	
Project Year	1	2	3	4	5
Total Estimated Population In-Migration into Lincoln County	171	339	425	429	412
Percent Addition to 2004 Lincoln County Population (18,866)	0.9 %	1.8%	2.3%	2.3%	2.2%

Source: Western Economic Services, LLC 2005.

3.17.4.2.5 Community Effects

The Impact Plan projected the allocations of in-migrating population to various settlement locations in Lincoln County including Libby, Troy, Eureka, and rural areas. Projections of in-migrating population from the beginning of mine construction through initial full production operations (*e.g.*, project Years 1-5) are presented in Table 131. Rural Lincoln County and Libby are predicted to receive the highest levels of new population.

Table 131. Expected Settlement Locations during Mining Operations.

Category	Construction Phase			Production Phase	
Project Year	1	2	3	4	5
Direct Construction and Production Employees					
Libby	35	72	94	95	94
Troy	2	5	6	6	6
Eureka	1	2	3	3	3
Rural Lincoln County	69	141	184	186	183
Total	107	220	288	291	287
Secondary Employees					
Libby	21	39	45	46	41
Troy	1	3	3	3	3
Eureka	1	1	1	1	1
Rural Lincoln County	41	76	89	89	81
Total	65	118	138	139	126
Combined Total In-Migration by Area					
Libby	56	111	139	141	135
Troy	3	8	9	9	9
Eureka	2	3	4	4	4
Rural Lincoln County	110	217	273	275	264
Total	171	339	425	429	412

Totals may not add due to rounding.
Source: Western Economic Services, LLC 2005.

The in-migration projections above incorporate the expectation that housing would be the primary limiting factor on the settlement of in-migrating workers, at least during early project years. Specifically, these projections assume that, with or without assistance from MMC, some temporary housing facilities would be developed near the project site on private lands. Such facilities would enable more workers to settle in this area than existing housing allows. Development of new housing to meet the needs of the entire expected non-local contract construction labor force is unlikely. Because of housing constraints, many would be forced to commute longer distances. Individuals hired for long-term mine jobs would have difficulty finding local housing. Some would have to settle initially in communities more distant from the mine and then relocate to permanent residences in the Libby/Troy/Eureka area after contract construction workers had left the area.

As noted in the Alternatives 1 and A, discussion of land use trends, population growth in the area is converting areas of private land from timber or agricultural production and open space use into residential subdivisions and ranchettes. The demand on public land resources is also shifting away from traditional resource commodity production toward a greater emphasis on recreation, and aesthetic values. Mine development would add to population and housing demand pressures. Land use demand driven by mine development would differ somewhat from the existing pattern driven by retiree and recreation/tourism/amenity in-migrant population growth. Although some mine employees would compete in the same market as other in-migrants for relatively large residential properties offering good scenic or other amenity values, most mine production

workers would be more likely to seek properties providing good basic family housing locations. The development of local businesses catering to new residential areas and commuting mine workers also would be expected.

Mine operations workers would have the kind of secure jobs with above-average wages that would allow them to purchase or build homes. Some in-migrants hired into secondary and replacement jobs would be in the same situation. Others would be more likely to need rental housing or mobile home spaces. In-migration during mine operations would place less strain on local housing supplies than would the earlier influx of construction workers.

While some in-migrants would be expected to become long-term residents and would seek to become integrated into the community, others would be well aware of their temporary status and unlikely to participate. An influx of temporary residents with large cash incomes, few ties to the community, and limited social and recreational opportunities may pose problems for limited law enforcement resources. To what extent these phenomena would surface in the western Lincoln County communities is difficult to predict, but it would be unrealistic not to expect some detrimental effects from the influx and departure of the large contract construction workforce.

3.17.4.2.6 Public Services

Local governments would need to serve fluctuating populations. Impacts to specific local governmental units within the study area due to in-migrating workers and their families depend entirely upon where the in-migrants choose to reside. In addition to housing-related factors affecting settlement patterns, in-migrants also would consider the availability of public services in making their residency choices.

Local government service-providers would have to plan for and deal with an influx of an estimated 171 in-migrants in the first year of mine construction followed by an expected peak in the fourth project year with about 429 total net in-migrants. The population increases during mine startup could cause difficulty for some service providers in responding to demands, requiring change in staffing and resource allocation. Because Lincoln County school enrollments were projected to decline over the next 10 to 15 years (if the mine were not developed), the arrival of students associated with mine operations would not be expected to create staffing or capacity difficulties.

Small communities that lack temporary housing facilities as well as a wide range of public and private services may experience law enforcement problems when a large temporary work force with no community ties, above-average income, marginal housing, and a high percentage of individuals who are not accompanied by families suddenly arrives. If such problems were to develop in association with the startup construction phase of the Montanore Project, these individuals would be more likely to reside in the communities located nearest to the mine site.

Community fire, emergency, medical, and social service providers would benefit from the additional tax revenues generated by the mine and should be able to adapt to the long-term changes in demand associated with mine operations. These service providers could have a hard time adjusting their staffing to the increases in service demands associated with mine construction and startup. Obtaining and training new staff takes time, and the fire and ambulance services, in particular, could experience difficulty finding and training additional volunteers. It is anticipated that the mine would maintain its own ambulance and would support and cooperate with local emergency service providers.

Projected revenues to meet the anticipated increase in public services costs are discussed in section 3.17.4.2.7, *Fiscal Effects* below.

3.17.4.2.7 Fiscal Effects

The proposed project would increase local and state government revenues and expenses. The Impact Plan included an analysis of project-related revenues and costs to affected local governments from the mine operations and population increases. Affected local government units within the defined Impact Plan study area include:

- Lincoln County Government (including special districts)
- City of Libby
- City of Troy
- City of Eureka
- Libby School District
- Troy Elementary School District
- Troy High School District
- Eureka Elementary School District
- Lincoln County High School District

New project-related revenues to local governments would come from three primary sources: property taxes on the mine land, plant, and equipment; the gross proceeds tax on the value of ore produced; and property taxes on new homes and commercial facilities built as a result of mine development. The project would increase costs for cities, schools, and counties through mine-related in-migration and resulting increases in local government service costs. The additional tax revenue would be used by local governments to pay for capital outlays, personnel, and support costs.

Lincoln County and the Libby, Troy, and Eureka school districts would be the primary recipients of tax revenues on the mine and mill facilities, but Montana law provides for tax-base sharing among affected Montana local government units when a mine is designated as a large-scale mineral development.

When construction of mine facilities is completed, the property tax revenue would be about $2.35 million represented by the land and improvements (*i.e.*, Class 4 property) and all the business equipment (*i.e.*, Class 8 property) (Western Economic Services, LLC 2005). This tax revenue would decline as the mine facilities and equipment depreciated, reaching fully depreciated values in 10 to 15 years. Annual local tax revenues would depend on local mill levy rates, state property tax equalization, and property tax prepayments and credits.

Montana levies a metal mines license tax on a mine's annual gross revenues in excess of $250,000. This is a percentage tax on the value of ore concentrate shipped to the refinery. Tax revenues would fluctuate depending on silver and copper prices and the project's annual production levels. By law, 75 percent of these revenues would be allocated to Montana's general fund. The remaining 25 percent would be allocated to Lincoln County, and distributed through the county to appropriate departments and districts. The county would be required to reserve at least 37.5 percent of this revenue in a trust fund account. All money not allocated to the trust fund

account is distributed as follows; 33.3 percent to elementary school districts, 33.3 percent to high school districts, and 33.3 percent for general planning functions (*e.g.*, economic development activities).

Table 132 summarizes projected fiscal effects from the project. Net impact to local governments would start with a $180,242 deficit in Year 1, followed by net surpluses starting in Year 2 with a net surplus of about $4.8 million in Year 5. MMC's proposed mitigation of $180,000 would mitigate for the Year 1 fiscal deficit. While not directly affected by the Montanore Project, Sanders County would receive $208,000 in gross proceeds tax in Year 4 and $546,000 in Year 5 (Western Economic Services, LLC 2005). The projected fiscal effects shown in Table 132 should be considered representative of actual fiscal effects, which would depend on a number of currently unknown factors and future local government conditions.

3.17.4.2.8 Quality of Life and Lifestyle

The Montanore Project would have relatively minor effects on social well-being and quality of life in the analysis area. Mining and other natural resource development has been an important part of the local economy for many years. Integration of newcomers should occur relatively easily. Individuals and social groups within the community would perceive project-related benefits, such as increased economic opportunity, and costs such as social problems associated with population growth, from the perspective of their own values, beliefs, and goals. Such perceptions would of course vary. Increased income within the analysis area would create new opportunities in the retail sales and service sector. Some residents believe the proposed project would revitalize and stabilize the depressed local economy.

Negative perceptions of project development may be attributed to people with various other points of view. Many residents express anxiety at the prospect of a major mineral development project, based on their experience with and perceptions of other mining projects. These concerns primarily are that the Montanore Project might generate similar problems, and that state and federal agencies might not adequately monitor and enforce applicable laws and regulations. Persons having these views want their feelings known, but are not necessarily opposed to development of the Montanore Project.

3.17.4.3 Cumulative Effects

In addition to the proposed Montanore Project, the proposed Rock Creek Project would affect Lincoln County. Other mineral activities in the area (*i.e.*, primarily small exploration projects) and the regional timber industry are not expected to lead to major developments in the reasonably foreseeable future.

The Rock Creek Project is a proposed underground copper and silver mine and mill/concentrator complex near Noxon, in Sanders County, Montana. The project is owned by Revett Silver, a wholly owned subsidiary of Revett Minerals, Inc. The nearest town to the proposed Rock Creek development is Noxon, an unincorporated town on Montana Highway 200 in Sanders County. Access to the Rock Creek mine would be from the Noxon area, and mine facilities also would be located in Sanders County.

Table 132. Net Local Government Fiscal Impact due to Montanore.

Category	Construction Phase			Production Phase	
Project Year	1	2	3	4	5
Costs					
Direct Worker Local Government Costs	$253,797	$563,239	$786,312	$798,962	$813,366
Indirect Worker Local Government Costs	$128,987	$236,679	$277,825	$281,063	$255,531
Total Costs to Units of Local Government	**$382,784**	**$799,918**	**$1,064,137**	**$1,080,025**	**$1,068,897**
Revenues					
Montanore Taxes:					
Metal Mines License Tax (to Lincoln County†)	0	0	0	$215,000	$565,000
Gross Proceeds Metal Mines Tax (to Lincoln County‡)	0	0	0	$832,000	$2,184,000
Gross Proceeds Metal Mines Tax (to Sanders County)	0	0	0	$208,000	$546,000
Montana Property Tax (land & improvements)	$10,000	$740,000	$1,290,000	$2,060,000	$2,060,000
Montana Property Tax (business equipment)	$80,000	$150,000	$210,000	$290,000	$290,000
Indirect Worker - Commercial Property Tax	$12,998	$23,774	$27,787	$28,017	$25,355
Direct Worker - Commercial Property Tax	$21,549	$44,204	$57,778	$58,445	$57,568
Indirect Workers - Residential Property Tax	$32,419	$59,296	$69,307	$69,880	$63,241
Direct Workers - Residential Property Tax	$45,576	$85,212	$102,036	$103,163	$97,269
Total	**$202,541**	**$1,102,485**	**$1,756,908**	**$3,864,505**	**$5,888,432**
Impact	**$-180,242**	**$302,567**	**$692,771**	**$2,784,479**	**$4,819,535**

†According to MCA 15-1-501 the Montana Metal Mines License Tax is allocated as follows: 57 percent to the state general fund, 2.5 percent to the hard rock mining impact trust account, 8.5 percent to the hard rock mining reclamation debt service fund, 7.0 percent to the reclamation and development grants program state special revenue account, and 25.0 percent to the county or counties identified as experiencing fiscal and economic impacts.
‡The allocation of the Montana Gross Proceeds Tax, a Class 2 Property Tax, was settled in the early 1990s.
Source: Western Economic Services, LLC 2005.

Based on recently completed permitting and a projected 3-year construction period, the earliest the Rock Creek Project could go into production is late 2010. Mine life of the Rock Creek operation is estimated to be 30 years. Annual earnings from direct and secondary mine-related employment would be about $14 million.

Total peak construction employment demand for the Rock Creek Project would be 345 workers, with a total peak employment demand of 355 employees during operations. The peak population increase associated with Rock Creek development in the Noxon/Heron/Trout Creek area (*i.e.*, western Sanders County) is projected to be about 328 people during project construction. The projected long-term population increase in the Noxon/Heron/Trout Creek area attributable to the Rock Creek Project is estimated to be about 378 people. The total peak population increase in Lincoln County from the Rock Creek Project during operations is estimated to be about 260 people. The vast majority of both positive and negative effects from Rock Creek development would occur in the Noxon/Heron/Trout Creek area.

A key factor determining the number of in-migrating workers for both the Rock Creek Project and the Montanore Project is the fate of the Troy Mine. The Troy Mine resumed operations in 2004 and has an estimated mine life of 6 years. Upon closure of the Troy Mine, a skilled workforce of 150 may be available either to the Rock Creek or Montanore projects. Depending on the timing of each project's start-up, there would be some direct competition for former Troy workers. Because much of the Troy Mine workforce already lives in the Libby area, some of these workers would be expected to seek employment with MMC at Montanore to avoid the longer commuting distance to the Rock Creek Project. Assuming Troy Mine closure and Rock Creek Project startup are relatively concurrent, many current Troy Mine workers would continue employment with Revett for the Rock Creek operation because of employee seniority and benefit vesting in Revett.

With the availability of the Troy Mine workforce for one or both of the new projects and current unemployment rates in Lincoln and Sanders counties, 80 percent local hiring for both projects would be still possible. If only one of the two projects is developed (either Rock Creek or Montanore, but not both), the displaced Troy Mine workforce may provide a substantial amount of the needed workforce. If Rock Creek is developed, but the Montanore Project is not, some Lincoln County residents currently working at the Troy Mine may migrate to Sanders County to shorten their commute.

If the Troy Mine (with additional reserves extending the mine life), Rock Creek, and Montanore were all to operate concurrently, which is considered unlikely based on available current information, the Troy Mine workforce would not be available to the two new projects, and the 80 percent local hiring assumption might not be met. This scenario would result in a larger population migration into Sanders and Lincoln counties than would result from the development of only one project. It also would result in the greatest level of community disruption.

Under the most likely situation, no in-migrating workers directly associated with the proposed Montanore Project are expected to reside in Sanders County. From a standpoint of cumulative impacts, the Montanore Project is not expected to have any direct effect on employment, population, or public services in Sanders County.

3.17.4.4 Regulatory/Forest Plan Consistency

The goal for mineral development in the KFP is to "encourage responsible development of mineral resources in a manner that recognizes national and local needs and provides for economically and environmentally sound exploration, extraction, and reclamation." The proposed Montanore Project would be consistent with this goal outlined in the KFP (USDA Forest Service 1987).

3.17.4.5 Irreversible and Irretrievable Commitments

There would an irreversible commitment of mineral resources under all of the action alternatives. Economic productivity for timber or other resources from mined lands would be irretrievable lost during mine operations.

3.17.4.6 Short-term Uses and Long-term Productivity

In the short term, the project would increase costs for cities, schools, and counties through mine-related in-migration and resulting increases in local government service costs. A short-term increase in population, as well as increases wages, spending, and tax revenue would occur over the life of the mine. Over the long term following mining, population and income levels may decline, as would the cost for local governments to provide services.

3.17.4.7 Unavoidable Adverse Environmental Effects

Under the No Action Alternative, local governments would not benefit from project-related revenues from: property taxes on the mine land, plant, and equipment; gross proceeds tax on the value of ore produced; and property tax on new homes and commercial facilities built as a result of mine development. Under all mine and transmission line alternatives, increased employment and population would place increased demands on housing and some public services, including schools, which would result in unavoidable adverse environmental effects.

3.18 Soils and Reclamation

3.18.1 Regulatory Framework

The KFP requires BMPs on National Forest System lands to limit soil erosion and to maintain soil productivity (USDA Forest Service 1987). In addition, chapter 2550 of the Forest Service Manual contains soil management objectives and policies applicable to activities on the KNF (USDA Forest Service 1990). Soil quality standards apply to lands where vegetation and water resource management (*i.e.*, timber sales, grazing pastures or allotments, wildlife habitat, and riparian areas) are the principal objectives. For these activities, the Forest Service Manual states that no more than 15 percent of an activity area may be detrimentally disturbed or if the area has greater than 15 percent disturbance presently there will be a net improvement after the activity is complete (this includes harvesting and site prep activities). This disturbance limit is in place to ensure that timber production can continue following these activities.

Areas on National Forest System lands with intense long-term development (*i.e.,* where the vegetation has been removed) are reallocated to non-timber production management, and lands that are changed in management type do not have to meet the 15 percent disturbance standard. As discussed in sections 2.12, *Forest Plan Amendment* and 3.14, *Land Use*, areas to be reallocated to non-timber production management would include the tailings impoundment, plant site, limited disturbances in LAD Areas, and portions of the transmission line corridor where the vegetation would be removed.

For this proposed project, the KNF emphasizes protection of the soil resources and implementation of restoration practices where necessary on National Forest System lands. Standards and BMPs identified in the KFP would be included as mitigation measures where appropriate and would be used to guide MMC's implementation of this project in respect to soil resources.

On the state level, the MMRA requires that all lands disturbed by mining to be reclaimed to a post-mine land use and be reclaimed to comparable stability and utility. The DEQ must evaluate MMC's proposed reclamation plan for areas to be revegetated to ensure that the soil needed to reclaim mine site disturbances would be salvaged and replaced, and areas revegetated to comparable stability and utility. The MFSA directs the DEQ to approve a facility if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impact, considering the state of available technology and the nature and economics of the various alternatives.

3.18.2 Analysis Area and Methods

The analysis area for soils that would be disturbed by facility construction under each alternative is shown on Figure 81. The Libby Loadout would be in the previously disturbed Kootenai Business Park, and the loadout is not discussed further.

Soil investigations for the mine area facilities and the transmission line corridors were conducted in 1988 and 1989 by Noranda to provide soil information for land use, management, and reclamation (Western Resource Development Corp. 1989b, 1989c). A detailed soil survey using standard USDA soil survey methods was performed in an "intensive study area," which included most of the Little Cherry Creek Tailings Impoundment Site and the Poorman Tailings

Impoundment Site, the Ramsey Plant and Libby Adit sites, and most of the two LAD Areas. The "extensive study area" consisted of the proposed access roads and transmission line corridors. Soils information from the KNF soil survey was used for the extensive study area (USDA Forest Service and Natural Resources Conservation Service 1995).

The soil baseline studies contain descriptions of field, laboratory, and interpretation methods (Western Resource Development Corp. 1989b, 1989c). Laboratory analyses were performed for selected physical and chemical parameters of the soils to assist with making interpretations important to mining operations and reclamation. Particle size analysis, percent rock fragments (> 2mm), organic matter percent, soil pH, and percent water at saturation were determined.

Soil interpretations were made for construction, management, and reclamation purposes. For the intensive survey area, soil erodibility, potential slope stability, and soil suitability were determined for each soil map unit. For the extensive study area, soil erodibility, slope failure, and revegetation potential were obtained from the KNF soil survey. Because the soils data for the extensive study area are more generalized, soil suitability was extrapolated from the intensive study area to provide more probable site-specific salvageable soil volumes.

Soil baseline studies and interpretations were used to access the likely effects for each alternative. Soil suitability was used to determine volumes of salvageable soil to be used for reclamation at each proposed disturbance. Soil erodibility was used to assess the susceptibility of the soils to erode when disturbed and the likelihood of eroded soil reaching stream channels. Slope failure was used to evaluate soil suitability for road construction and maintenance.

3.18.3 Affected Environment

Soils in the analysis area have been influenced by four geomorphic processes: colluvial (movement downhill as a result of gravity); fluvial (movement by flowing water from streams and rivers); glaciolacustrine (movement or deposition in lakes); and glacial (movement by glaciers). In addition to these four processes, a thin mantle of volcanic ash-influenced loess (fine textured soil deposited by wind) blankets much of the analysis area soils. The loess commonly differs sharply from the soil beneath it. The ash-influenced loess generally contains less rock fragments, has a higher moisture-holding capacity, and can be extremely susceptible to erosion.

Within the analysis area, the soils vary in age, degree of development, and fertility. Relatively young soils forming in colluvial material generally have little development, are typically high in rock fragments, and generally are infertile. Soils associated with alluvial processes are also relatively young, have little or no development, have abundant rock fragments, and generally are infertile. Soils forming in glaciolacustrine sediments are of late-Wisconsin glacial age (10,000-25,000 years before present), show weak to strong development, are typically high in silts and clays with few rock fragments, and are relatively fertile to infertile. Other intermediate aged soils have some development, are relatively fertile to infertile, and have some rock fragments. The oldest soils, associated with continental glaciation, are strongly developed, have clay to silty clay textures, and are some of the more fertile soils in the permit area.

3.18.3.1 Soil Types

Soils within the analysis area can be divided into six general groups based on the parent material and the type of geomorphic process in which they formed (Figure 81). The soil group

"colluvial/glacial soils" was mapped only in the intensive study areas; because of the scale of mapping, it is not shown in Figure 81. The six groups are:

- Alluvial soils that formed in rocky alluvium
- Glaciolacustrine soils that formed in fine-textured glaciolacustrine deposits
- Alpine glacial soils that formed in rocky alpine glacial drift
- Continental glacial soils that formed in rocky continental glacial drift
- Residuum/glacial soils that formed in rocky residuum and glacial drift
- Colluvial/glacial soils that formed in rocky colluvium and glacial drift

3.18.3.1.1 Alluvial Soils

The alluvial soils are deep, well drained to very poorly drained, and contain a high amount of rock fragments. They formed in gravelly and cobbly coarse-textured alluvium and have a volcanic ash surface layer. They occur on nearly level to strongly sloping alluvial and glaciofluvial terraces, terrace escarpments, drainage bottoms, old lake beds, and floodplains. These soils are moderately extensive along Poorman, Libby and Bear creeks at the Little Cherry Creek and Poorman Tailings Impoundment sites, the Ramsey Plant Site, the Libby Adit Site, and along the Fisher River valley bottom near the transmission line alignments. Narrow areas of alluvial deposits occur along all streams in the analysis area. Depth to the water table is variable, with some soils saturated most of the year. Included in this soil group within the proposed Little Cherry Creek Tailings Impoundment Site are very poorly drained areas, such as bogs and wet depressions that contain organic-rich soils.

The surface textures are generally loam, gravelly silt loam, and very gravelly sandy loam with 5 to 55 percent rock fragments. Subsoil textures are generally gravelly silt loam, extremely gravelly silt loam, and loamy sand with 15 to 75 percent rock fragments. Rocky colluvial soils occur on many toeslopes within this soil group. Organic matter content is medium to very high (3 percent to greater than 50 percent in some poorly drained areas) in the surface layers and is typically much lower in subsoil layers. The soils are very strongly acid to moderately acid (pH 4.5 to 5.7). Available water holding capacity is low to high, and soil permeability is slow to rapid. Generally, the surface layers of these soils have low to moderate susceptibility to erosion by water and low to high susceptibility below the surface layer. The soils have low to high sediment delivery efficiency, which is the relative probability of eroded soil reaching a stream channel, and they have high slope stability.

3.18.3.1.2 Glaciolacustrine Soils

Glaciolacustrine soils are deep, well drained, and relatively free of rock fragments. They formed in fine-textured glacial lake sediments and have a volcanic ash surface layer. They are found on nearly level to strongly sloping glaciolacustrine terraces and steep to very steep terrace risers. These soils are of moderate extent in the Little Cherry Creek and Poorman Tailings Impoundment sites, and they occur along the transmission line alignments. Included in this soil group within the proposed Little Cherry Creek Tailings Impoundment Site are very poorly drained areas, such as bogs and wet depressions that contain organic-rich soils

The surface textures are generally silt loam with few rock fragments. Subsoil textures are generally silt loam, silty clay loam, and silty clay with few rock fragments. Clay contents in subsoil layers can exceed 45 percent. Organic matter content is medium (2 to 3 percent) in the

surface layers and is typically less than 1 percent below the surface layer. The soils are strongly acid to slightly acid (pH 5.4 to 6.2). Available water holding capacity is high, and soil permeability is very slow. Generally, the surface layers of these soils have moderate to high susceptibility to erosion by water and high susceptibility below the surface layer. The soils have low to moderate sediment delivery efficiency. They generally have high slope stability, but exhibit cutbank sloughing on slopes greater than 15 percent.

3.18.3.1.3 Alpine Glacial Soils

Alpine glacial soils are deep, well drained, and contain a large percentage of rock fragments. They formed in gravelly, medium-textured glacial drift and have a surface layer of volcanic ash. They occur at higher elevations on gently to steep glacial moraines and glacial valleys. In places, rock outcrops are extensive within this soil group. These soils are moderately extensive in the valleys at the Ramsey Plant Site, Libby Adit Site, Rock Lake Ventilation Adit, and along the transmission line alignments.

The surface textures are generally gravelly silt loam with about 20 percent rock fragments. Subsoil textures are generally very gravelly silt loam with 40 to 60 percent rock fragments. Organic matter content can be very high in the surface layer due to ash influence, but drops off rapidly to less than 1 percent a few feet below the surface. The soils are generally very strongly acid to strongly acid (pH 5.0 to 5.5). Available water holding capacity is moderate, and soil permeability is moderate to high. Generally, both the surface and subsurface layers have moderate to high susceptibility to erosion by water. The soils have low to high sediment delivery efficiency. They are commonly susceptible to cutbank sloughing and raveling.

3.18.3.1.4 Continental Glacial Soils

Continental glacial soils are deep, well drained, and rocky. They formed in gravelly, fine-textured old glacial drift and have volcanic ash surface horizons. Some soils in this group formed in rocky colluvium. This soil group, which is at lower elevations than the alpine glacial soils, occurs on nearly level to very steep, continentally glaciated plains, mountain side slopes, and ridges. In places, rock outcrops are extensive within this soil group. These soils are very extensive along the transmission line alignments, at the Little Cherry Creek and Poorman Tailings Impoundment sites, making up over half of the impoundment sites, and most of the Libby Plant Site and LAD Areas. Included in this soil group within the proposed tailings impoundment sites are very poorly drained areas, such as bogs and wet depressions that contain organic-rich soils.

The surface textures are generally silt loam, gravelly silt loam, and clay loam with few to 30 percent rock fragments. Subsoil textures are generally very gravelly, moderately fine and fine textures with 10 to 60 percent rock fragments. Clay contents can exceed 60 percent in the subsoil. Organic matter content is medium to high (2 to 5 percent) in the surface layer, but decreases to less than 1 percent below the surface. The soils are generally very strongly acid to moderately acid (pH 4.7 to 5.9) but can be mildly alkaline in the substratum. Available water holding capacity is moderate to high, and soil permeability is very slow to slow. Generally, both the surface and subsurface layers of these soils have moderate to high susceptibility to erosion by water. The soils have low to high sediment delivery efficiency. They are commonly susceptible to cutbank sloughing and landslides can occur in steep drainageways.

3.18.3.1.5 Residuum/Glacial Soils

Residuum/glacial soils are shallow to deep, well drained, and contain a high amount of rock fragments. They formed in gravelly medium textured glacial drift and meta-sedimentary residuum

and have a volcanic ash surface layer. They occur on gently sloping to very steep glacial scoured ridge tops, glacial trough walls, and valley side slopes. They are moderately extensive in the Little Cherry Creek and Poorman Tailings Impoundment sites, and they occur along the transmission line alignments.

The surface textures are generally silt loam and gravelly silt loam with few to 30 percent rock fragments. Subsoil textures are generally very gravelly loam with up to 60 percent rock fragments. Rock outcrops occur throughout these soils. Organic matter content is moderately low in the surface layer and low below the surface. The soils are generally very strongly acid to moderately acid (pH 5.2 to 6.0). Available water holding capacity is low, and soil permeability is moderate to rapid. Generally, the surface layers of these soils have moderate susceptibility to erosion by water, and have low susceptibility to erosion by water below the surface layer. These soils have low to high sediment delivery efficiency. They commonly exhibit high slope stability but landslides can occur in steep drainageways, and sloughing and raveling can occur if cutbanks are steep. Avalanche paths occur on some very steep slopes.

3.18.3.1.6 Colluvial/Glacial Soils

The colluvial/glacial soils are moderately deep to deep, well drained, and contain high amounts of rock fragments. They formed in gravelly and cobbly medium textured colluvium and glacial drift and have volcanic ash surface layers. They occur on gently sloping to very steep colluvial and glacial side slopes, ridge tops, in cirque basins (semicircular basins near valley heads in mountains caused by glacial erosion), and in avalanche chutes and debris deposits. These soils are extensive at the Ramsey Plant Site. Several avalanche debris fans are located at the Libby Adit Site.

The surface textures are generally silt loam to extremely gravelly silt loam with 10 to 80 percent rock fragments. Subsoil textures are generally very gravelly silt loam and extremely gravelly loam, silt loam, and sandy loam with 35 to 87 percent rock fragments. Many of these soils have a large amount of stones and boulders covering the surface, and rock outcrops occur as inclusions. Organic matter content is medium to high (3 to 6 percent) in the surface layers and is typically less than 1 to 3 percent in subsoil layers. The soils are strongly acid to slightly acid (pH 5.3 to 6.1) but are extremely acid with a pH of 4.4 in areas at the Libby Adit Site. Available water holding capacity is low to moderate and soil permeability is moderate to rapid. Generally, the surface layers of these soils have low to moderate susceptibility to erosion by water and low susceptibility to erosion by water below the surface layer. The soils have moderate to high sediment delivery efficiency. Generally on shallower slopes (less than 25 to 35 percent), these soils have high slope stability and have moderate to low slope stability on steeper slopes.

3.18.3.2 Suitability for Reclamation

The soils in the analysis area are generally suitable for salvage and replacement. Relatively organic-rich surface layers range from 5 to 29 inches thick and average about 10 inches thick. Subsoils are also suitable for salvage and use in reclamation. Salvageable soil, including both surface soil and subsoil layers, ranges from 9 to 33 inches. Organic matter levels in surface soils are generally moderate to high, and pH values range from 4.4 to 6.6, but are typically between 5 and 6. Because of volcanic ash, the surface layers are typically medium textured and have a high water holding capacity. Some surface layers of colluvial/glacial soils have a moderate water holding capacity. A high water table would preclude salvage of some alluvial soils. Soils on

slopes greater than 50 percent are considered unsuitable for salvage per DEQ soil salvage guidelines.

The primary limitation to soil suitability for reclamation is rock fragment content. Soils with more than 50 percent rock fragments are generally considered unsuitable per DEQ guidelines, unless they are needed to control erosion on steep slopes. Surface soils commonly have 10 to 50 percent rock fragments, but glaciolacustrine surface layers are relatively free of rock fragments. Many of the colluvial/glacial soils contain high amounts of stones and boulders on the surface. Salvageable soils with stones and boulders would require special handling. Subsoil layers are more variable in texture and pH, but generally have high amounts of rock fragments, except for glaciolacustrine subsoil layers, which generally lack rock fragments. The soils are rated good to poor for road suitability. Poor ratings are typically due to steep slopes and susceptibility of slope failure. Glaciolacustrine soils are rated poor for road suitability due to slumping, and some alluvial soils are rated poor due to excess water. None of the soils in the analysis area have severe reclamation constraints.

3.18.4 Environmental Consequences

This section addresses soil impacts resulting from the action Alternatives 2, 3, and 4. The impacts are typical of any operation where soil would be removed, stored, and replaced. First, the effects to soils that would be common to all action alternatives are presented followed by the effects to soils that would be unique to each alternative. Soil impacts resulting from all action alternatives would include:

1) Soil loss from erosion of disturbed areas and losses of salvageable materials through erosion and handling

2) Changes in soil physical, chemical, and biological characteristics

3) Reduction in plant growth due to potentially harmful metals in some subsoils because of the acid pH levels and in mine wastes that would be part of the revegetated plant community rooting zone

These impacts, combined with the project's reclamation plan, determine in part, the potential success of reclaiming the land to forest cover and wildlife habitat after operations ceased. Limited reclamation success, in turn, may result in secondary or long-term negative impacts including soil erosion, sedimentation to streams, reduced soil/site productivity, and visual deterioration.

3.18.4.1 Effects Common to All Action Alternatives

3.18.4.1.1 Soil Loss

Areas cleared of vegetation would be susceptible to erosive forces and soil loss. Loss of soil also would occur from the removal and storage of soils during mine operations and from erosion of exposed soils during reclamation and stabilization. Soil erosion caused by wind or water likely would occur during all phases of the project. Initial erosion rates would be moderate to high due to soil exposure, slope steepness, and precipitation patterns. Soil losses on undisturbed lands in northwestern Montana are commonly less than 2 tons/acre/year, but under all action alternatives, soil loss rates would likely exceed 2 tons/acre/year on all disturbed areas until vegetation was established and roads were chip sealed or graveled. Following reclamation, soil losses of less than 2 tons/acre/year are typically needed for successful revegetation. Native plant communities

typically take 3 to 5 years to establish, and longer on steep slopes and road cuts, especially on south- and west facing slopes.

Losses of soil at disturbances, such as Ramsey and Libby Plant Sites, Libby Adit Site, Little Cherry Creek and Poorman Tailings Impoundment sites, and soil stockpiles would be captured by sediment control BMPs. Soil losses at soil stockpiles also would be controlled by installing berms around the stockpiles.

Soil losses would occur at cut-and-fill slopes at the plant sites, at mine and transmission line access roads, and at staging areas. Fill slopes would be particularly susceptible to failure, and difficult to revegetate, and cut-and-fill slope raveling (movement of dry soils) may be difficult to control in some locations. Construction of new roads and upgrading of existing roads would cross areas where soils have a severe erosion risk, high sediment delivery potential to enter waterways, and potential for slope failure. Some roads would be reclaimed as work progressed, so surface erosion would be limited. Road-building in steep terrain typically results in accelerated erosion and sedimentation (Megahan and Kidd 1972 *In* USDA Forest Service and DEQ 2001; Packer 1966 *In* USDA Forest Service and DEQ 2001). Increases would be highest within the first 2 years, but erosion may continue for long periods depending on site conditions. Because precipitation is high in the area, cut-and-fill slopes would be immediately stabilized to reduce potential erosion.

Road cut-and-fill slopes and other disturbances along roads would be seeded, fertilized, and stabilized with hydromulch, netting, or by other methods as soon as final grades are achieved after construction to minimize erosion and to avoid crusting of the soil surface. Soil crusting would reduce seed establishment and water infiltration and result in more runoff and erosion. Following construction of the transmission line, interim reclamation (removal of drainage obstructions at road crossings, replacement of soil where it was removed and reseed) would be used on transmission line access roads placed into intermittent stored service to stabilize the surface and reduce erosion. Erosion from the transportation system would increase during and after (for up to 5 years but possibly more on south- and west-facing cut slopes) construction and reconstruction until cut-and-fill slopes were stabilized. All new roads would be decommissioned at the end of operations when no longer needed and most other currently existing roads would be reclaimed to preoperational conditions. Some roads would be covered by the tailings impoundment in all mine action alternatives.

Unprotected road surfaces would be susceptible to erosion. Access roads operational for mine life would be chip sealed or graveled, which would reduce potential erosion, and BMPs would be used to control drainage from road surfaces. For existing roads needing upgrading, sediment controls would be upgraded/installed and appropriate BMPs would be implemented, which in the long run, would reduce soil loss from existing road corridors.

Erosion would occur during reclamation activities when salvaged soils are spread on recontoured surfaces. Areas reclaimed using direct-hauled soils (a reclamation technique whereby soil is stripped from an undisturbed area and immediately placed on a disturbed area that has been prepared for reclamation), such as road cut-and-fill slopes and in places at the Little Cherry Creek and Poorman Tailings Impoundment sites, would have less potential for erosion than areas reclaimed with stored soil. Protective vegetation would establish more quickly because direct-haul soils are still biologically active and retain a higher level of favorable physical and chemical characteristics than soils stored for prolonged periods. Only a small, undetermined percentage of

the total volume proposed for salvage would be direct-handled because of the timing difference between construction and reclamation.

Wind erosion of exposed soil also would contribute to soil losses. To minimize soil wind erosion, MMC would use standard BMPs, such as periodic watering of unpaved roads and disturbed surfaces, and use of mulch and tackifiers on exposed surfaces until vegetation was established.

Soil losses would occur under all action alternatives, and even with erosion and sediment control BMPs, some sedimentation is expected in waterways down gradient of disturbances. Soil losses generally would be long-term within all disturbed areas, because erosion rates would remain elevated after reclamation until the vegetation ground cover approaches predisturbance levels in 3 to 5 years. South- and west-facing cut slopes may require more than 5 years for the vegetation ground cover to reach predisturbance levels without soil amendments. Once vegetation was well established, soil losses would be similar to pre-mine rates.

3.18.4.1.2 Soil Physical, Biological, and Chemical Characteristics

Soil characteristics that would be impacted by all action alternatives would include potential changes in soil physical and chemical properties, biological activity, and nutrient levels. Soil structure would be altered by handling, salvage, and storage operations. Changes in chemical properties such as heavy metal concentrations and soil pH may also occur at the mine facilities. These changes to the soil characteristics are discussed below.

Physical Characteristics

Changes in physical properties of the soils due to handling, salvage, and storage would result in the alteration of the natural soil profile that has developed since the last major soil disturbing event such as glacial activity, volcanic ash deposition, or flooding. This would be an unavoidable impact of salvaging and replacing soils. Some of these areas have been logged in the past, which disturbed the surface soil profile but not to the extent that mining disturbance would. Soil structure, compaction (destruction of pore space continuity and soil structure), and loss of organic matter due to mixing and storage would occur. Soils salvaged and replaced in a single lift would alter the natural soil profile due to mixing of soil horizons, which would be a long-term impact. Two-lift salvage and replacement is proposed in the tailings impoundment areas that would limit some of the mixing across soil horizons, but the impacts would still be long term. The establishment of vegetation, root systems, and physical processes, such as freezing and thawing, and wetting and drying, would restart the soil-building processes and help rebuild the natural soil profile, but this would require a long time.

Compaction from heavy equipment would adversely affect soil plant relations due to decreased soil water-holding capacity, loss of aeration and pore space, and increased soil bulk density (Sharma 1996 *In* USDA Forest Service and Montana DEQ 2001). Coarse-grained soils and fine-grained matrix soils that have a large volume of rock fragment, may or may not be as affected, depending on the overall soil composition (Sowers 1979 *In* USDA Forest Service and DEQ 2001).

The volcanic ash component of many of the surface soils proposed for salvage may provide some resistance to severe compaction caused by equipment operation and the sheer weight of the stockpiles. Volcanic ash-influenced soils in northwest Montana have lower initial bulk densities than soils derived from other sources. When disturbed during activities that use heavy equipment (such as logging), these soils would compact but not as severely as other soils (Kuennen *et al.*

1979 *In* USDA Forest Service and DEQ 2001). The reasons for this are not well understood, but they appear to relate to the porous nature of ash particles, how they naturally aggregate, and how they interact with organic matter (Harwood and Youngberg 1969 *In* USDA Forest Service and DEQ 2001; Nimlos 1981 *In* USDA Forest Service and DEQ 2001). Additionally, studies have not explored the behavior of ash-influenced soils under prolonged storage in deep piles; therefore, it is not possible to quantify the potential resistance to compaction of these soils.

Fine-textured glaciolacustrine subsoils are susceptible to compaction during the soil salvage process and have lower inherent infiltration and permeability. Non-glaciolacustrine soils in the area would not be as susceptible to this compaction because they often have greater sand and rock fragment contents.

To reduce compaction, severely compacted areas, such as roads, soil stockpile sites, and facility sites, would be ripped prior to soil placement, and seedbeds would be disked and harrowed prior to seeding. Soil compaction would be short-term in all disturbed areas with these mitigation measures, and following reclamation compaction in respread soils that are ripped would be similar to pre-mine soils.

Biological Activities

Biological changes would occur in salvaged soils. Since most disturbances would not be reclaimed until the end of operations, most salvaged soils would be stockpiled for 15 years or more. Soils salvaged along transmission line roads would be respread within a year. Prolonged storage decreases or eliminates populations of important soil microorganisms (Miller and Cameron 1976 *In* USDA Forest Service and DEQ 2001), such as bacteria, fungi, and algae, which are essential in soil nutrient cycling. In addition, some favorable components normally found in native soils are lost through decomposition during storage. These components include seeds of native plants, rhizomes (underground stems), and other plant parts capable of producing new plants. Replenishment of soil microorganisms would occur with interim revegetation of soil stockpiles but would be limited to the surface (the top 6 to 8 inches) of the stockpile. Most stockpiled soil would have reduced biological activity.

Mycorrhizae (important structures that develop when certain fungi and plant roots form a mutually beneficial relationship) are also eliminated in soil stored for prolonged periods. Mycorrhizae serve as highly efficient extensions of plant root systems, especially for woody species. These associations are important to consider in maximizing plant establishment and productivity because most plants depend on mycorrhizae for adequate growth and survival (Mallock *et al.* 1980 *In* USDA Forest Service and DEQ 2001; Trappe 1981, *In* USDA Forest Service and DEQ 2001). This is especially true in nutrient deficient soils. All of the salvaged soils are relatively infertile. Mycorrhizae are particularly important to plant phosphorus nutrition and water uptake (Christiansen and Allen 1980 *In* USDA Forest Service and DEQ 2001). Thus, the association of mycorrhizae with plants in the study area is especially critical because plant-available phosphorus is expected to be low.

Chemical Characteristics

Aluminum, iron, and manganese are found in native forested soils in the area. These common metals are released by the weathering of soil parent materials, even in non-mineralized areas. They can become concentrated in a particular soil horizon by various soil-formation processes. Although typically not available to plants at neutral pH values, if soil surveys indicate soil pH is around 5.0, the agencies would require soil metal testing to identify possible naturally occurring

concentrations of these and other metals. Soil samples tested had pH values from 4.3 to 7.5, with values between 5.0 and 6.0 being the most common. Samples with low pH were generally from the Little Cherry Creek and Poorman Tailings Impoundment sites, but soils with low pH potentially occur at all proposed disturbance areas. Soils having pH conditions below 5 are not proposed to be salvaged. Aluminum in particular may be slightly elevated in volcanic ash-rich loess. Elevated aluminum levels are common in forested soils of northwest Montana, and native vegetation likely has adapted to the ambient soil chemistry.

Heavy metals often associated with mineralized zones, such as lead and copper could hinder plant growth. None of the rock types tested during exploration and past mining operations exhibited highly elevated leachable metal concentrations, which are metals that would become soluble in soil water (see section 3.8, *Geology* for detailed discussion of leachable metals). Preliminary testing shows tailings materials and some of the mine waste rock would have low levels of leachable metals and no net acid generation potential. Considering these results, the mine waste materials would have limited adverse chemical impacts on respread soil or on plants whose roots may grow into these materials in the lower part of the rooting zone. MMC would test waste rock and tailings prior to soil redistribution to reconfirm these results.

3.18.4.1.3 Reclamation Success

Recognition of inherent soil properties and design of salvage programs to retain favorable properties can enhance reclamation success. Soil characteristics important to consider for analyzing impacts and assessing soil salvageability and suitability for reclamation include:

- depth and horizon (developed soil layer) sequence
- texture (relative proportion of sand-, silt-, and clay-sized particles)
- coarse fragment content (size, amount, and shape (rounded or angular))
- erodibility
- organic matter content
- reaction (refers to the acidity or alkalinity of the soil solution and is expressed as pH ranging from 1 to 13, where 1 is the most acidic, 7 is neutral, and 13 is most alkaline or basic)
- slope steepness; and location and extent of rock outcrop and talus

Soil Salvage and Handling

The potential for reclamation success of disturbed lands is greatly improved when soil is salvaged and later replaced as a growth medium for plants. MMC would salvage and replace soils on most disturbed areas, except where slopes are too steep, at soil stockpile areas, and where soils are too rocky. The primary limitations that affect soil suitability for salvage and reclamation at the site include rock content and steep slopes, and to a lesser extent, soil texture, soil pH, and a high water table. Salvage may be limited for soils with a volume of more than 50 percent rock fragments (larger than 1/16 inch diameter) or with large rocks (greater than 2 feet in diameter). Soils with up to 60 percent rock fragments would be salvaged in some areas to provide erosion protection on the steep embankment of the Little Cherry Creek and Poorman Tailings Impoundment sites. Salvage would not be required and not be conducted on slopes exceeding 2:1 (50 percent) because of worker safety considerations. Other reclamation limitations at the site include soils with high clay content and pH levels below 5.

Soil Amendments

Reclamation success can be enhanced on particular sites by use of soil amendments. Use of mulches and tackifiers can limit soil loss until seedlings can establish. Alkaline amendments can be added to acid soils to raise the pH. Wood based organic amendments can be added to the surface soil to increase organic matter contents, reduce compaction, increase soil fertility, and enhance establishment of a fungal based mycorrhizae community that would enhance the establishment and growth of woody plant species. MMC has only proposed the use of mulches to reduce soil erosion.

Revegetation

The main factors relating to revegetation include scheduling of final revegetation, species selection, planting plans, and establishing success criteria to achieve long-term plant cover and density objectives. These factors determine the speed and success of reclaiming the disturbed lands to comparable stability and utility.

MMC would not implement final reclamation for most disturbances until the post-operational phase (after 15 to 20 years). Final reclamation would be done on some sites during the predevelopment period (1 to 3 years). These areas would include the Little Cherry Creek Diversion Channel (Alternatives 2 and 4), cut-and-fill slopes at plant sites, portal patio faces, and the Bear Creek access road north of the proposed Little Cherry Creek Tailings Impoundment. Disturbances reclaimed during operations would include some temporary access roads. Interim reclamation, (replacing soil where it was removed and reseeding) would occur on transmission line access roads placed into intermittent stored service. All other disturbances would be reclaimed after operations cease.

3.18.4.2 Soil Loss

3.18.4.2.1 Alternative 1 – No Mine

Under Alternative 1, the Montanore Project would not be developed. Soil resource impacts would be limited in comparison to the other alternatives. Soil loss due to erosion would be restricted to existing exploration-related or baseline data collection disturbances. All existing soil disturbances by MMC would be reclaimed in accordance with existing laws and permits. Erosion and sedimentation would occur at existing rates along NFS road #278 and other existing roads. Soil erosion losses due to rainfall, runoff, and wind would continue at natural rates at other locations in the analysis area.

3.18.4.2.2 Alternative 2 – MMC's Proposed Mine

Soil losses would occur during construction of access roads and facilities, at soil stockpiles, and when soils are salvaged and respread. Table 133 presents a comparison of the likely disturbances in which soil would be salvaged and salvageable soil volumes of mine facilities for each alternative. The disturbance acres in Table 133 do not include proposed soil stockpiles and existing roads because no soil would be salvaged from these areas. Soil would be salvaged from only small portions of LAD Areas such as roads and ponds. The Libby Adit Site is an existing disturbance area, and soil has already been salvaged and stockpiled at the site, so it is not included in Table 133. The soil loss impacts described below are specific to Alternative 2.

Table 133. Comparison of Disturbances from Soil Salvage and Salvageable Soil for Alternatives.

Disturbance	Units	Alternative 2 – MMC's Proposed Mine	Alternative 3 – Agency Mitigated Poorman Impoundment Alternative	Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative
Tailings Impoundment/Dam†	Acre	620	608	620
Lift 1	cy	754,166	715,500	754,166
Lift 2	cy	1,224,076	1,306,500	1,224,076
Seepage Collection Pond	Acre	8	18	8
Lift 1	cy	8,927	18,042	8,927
Lift 2	cy	20,167	38,992	20,167
Borrow Areas outside tailings impoundment	Acre	419	92	252
Lift 1	cy	393,690	117,464	317,249
Lift 2	cy	393,690	85,305	249,895
Diversion Channel	Acre	40	0	40
Lift 1	cy	50,780	0	50,780
Lift 2	cy	0	0	18,486
Other potential disturbances‡	Acre	788	597	629
Lift 1	cy	979,737	736,944	771,967
Lift 2	cy	1,280,675	824,050	1,182,178
Plant Site	Acre	52	104§	104§
Lift 1	cy	126,000	135,722	135,722
Upper Libby Adit	Acre	0	1	1
Lift 1	cy	0	538	538
LAD Areas	Acre	31	16	16
Lift 1	cy	37,739	19,723	19,723
Lift 2	cy	0	7,663	7,663
Roads	Acre	149	135	135
Lift 1	cy	333,973	151,371	151,116
Lift 2	cy	0	172,699	162,543
TOTAL	Acre	2,107	1,567	1,805
Lift 1	cy	2,685,012	1,902,551	2,210,188
Lift 2	cy	2,918,608	2,448,213	2,865,008

† Entire tailings impoundment areas also include Seepage Collection Pond, borrow areas outside tailings impoundment footprint, Diversion Channel (Alternatives 2 and 4), and other potential disturbances.
‡ Includes roads, storage areas, ditches, pipelines, etc. Does not include soil stockpiles and existing roads.
§ Soils not mapped at intensive level, suitable lift-2 soils likely present; does not include soil stockpile areas and existing roads; acreage may differ from disturbance acres presented in Table 5 for Alternative 2, Table 14 for Alternative 3, and Table 29 for Alternative 4 in Chapter 2.
cy = cubic yard.

Source: GIS analysis by ERO Resources Corp. using soils mapping in Western Resource Development Corp. 1989b, 1989c.

Alternative 2 - Soil Losses from Construction of Facilities and Roads

Construction of mine related facilities and roads would result in soil disturbance and a loss of soil productivity on about 2,107 acres (Table 1). Much of the facility disturbances would be covered with structures, such as buildings, or other material, such as tailings and waste rock.

New roads, upgrading existing roads, and pipeline corridors would result in a total disturbance area of 149 acres. Unprotected road surfaces would be susceptible to erosion. For access roads operational for mine life, MMC would chip seal or gravel road surfaces, which would reduce potential erosion, and BMPs would be used to control drainage from road surfaces. For existing roads needing upgrading, MMC proposes to upgrade/install sediment control and implement appropriate BMPs, which in the long run, may reduce total soil loss.

Areas of culvert replacement and/or extension and bridge construction at Ramsey Creek and Poorman Creek would be subject to erosion until stabilized. Short-term increases in sedimentation may occur as a result.

MMC proposed a 10,800-foot Little Cherry Creek Diversion Channel around the tailings impoundment that would flow into Libby Creek. The Diversion Channel would consist of two main sections: an upper engineered channel (designed for the 6-hour Probable Maximum Flood flow and the riprapped channel sides for the 100-year flood flows), and two existing natural drainage channels tributary to Libby Creek (Figure 8). Both tributary channels would receive flow from the Upper Diversion Channel, which would reduce channel impacts that can occur during peak flow events. The lower tributaries are not large enough to handle the expected flow volumes; these tributaries would undergo channel adjustments until they stabilized. These adjustments would include bank erosion, channel scouring, and sloughing of bank material, which would contribute sediments to Libby Creek.

MMC would construct some bioengineering and structural features based on need and access in the two unnamed tributary channels to reduce flow velocities, minimize erosion in the unnamed tributaries, minimize sedimentation to Libby Creek, and create fish habitat. In addition, MMC would evaluate potential locations for creating wetlands and ponds in low gradient areas to capture and retain most of the sediments generated from the unnamed tributaries and minimize sedimentation to Libby Creek. If wetlands or ponds were not constructed to retain mobilized sediments on the Libby Creek floodplain, the additional input of sediments to Libby Creek may cause channel aggradation, which may result in bank erosion due to channel widening. Bank erosion in the unnamed tributaries and possibly sedimentation to Libby Creek would continue until the tributaries adjusted to the increased flow volumes (see section 3.6, *Aquatic Life and Fisheries*). If substantial erosion occurred once the diversion channel was operational, additional erosion control structures would be constructed as needed.

Once the tailings impoundment was reclaimed, there would be a slight increase in flow to Bear Creek from runoff from the impoundment surface. This runoff would flow to Bear Creek via a diversion ditch. The ditch would be riprapped to minimize erosion and sedimentation in Bear Creek. A small rockfill check dam would be located just beyond the northwest end of the reclaimed impoundment. If necessary, sediment would be removed from the pond. The check dam would be designed for the 100-year flood event. Short-term erosion in the ditch and subsequent sedimentation in Bear Creek would likely occur during construction of the ditch and check dam. With the additional flow, especially after large runoff events, there could be minor adjustments to the Bear Creek channel resulting in minor scouring and bank erosion.

Alternative 2 - Soil Losses at Soil Stockpiles

All soil stockpiles would be susceptible to erosion. Soil stockpiles would be constructed with 40 percent side slopes and 33 percent sloping ramps where possible. MMC proposes to stabilize stockpiles when they reach their design capacity and seed during the first appropriate season following stockpiling. This would leave exposed soil on steep slopes for potentially prolonged periods. If left exposed and unprotected for more than a couple of months, regardless of other characteristics, large amounts of soil may erode. To minimize sedimentation to floodplains, wetlands and streams, MMC proposes to locate soil stockpiles on gentle slopes away from drainages, install berms around stockpiles, and construct sediment traps downslope of soil stockpiles where necessary.

Apart from erosion resulting from steep slopes and exposure, each stockpile would have a different potential for erodibility. Each stockpile includes soils from adjacent or nearby salvage areas, thus the nature of each stockpile would be different in terms of soil texture and rock content. For example, soils at the Ramsey Plant Site would be salvaged in one lift and would be composed of predominately silt loam with lesser amounts of gravelly silt loam and very gravelly silt loam. Due to the high silt content and only some soils having high gravel content, these stored soils would have a moderate to high erodibility potential. Some soils at the Little Cherry Creek Tailings Impoundment Site would be salvaged in two lifts and stored separately. The surface lift, which includes the more suitable soil, would be comprised of fine-textured volcanic ash, silt loam, gravelly silt loam, and gravelly loam. First lift stockpiles would have moderate to high erodibility potential due to the high silt content and low rock fragment content. The second lift would be composed of gravelly to very gravelly loam and clay loam. Second-lift stockpiles would have moderate erodibility potential due to higher rock fragment content and less silt.

For new roads that are to be operational for mine life, MMC proposes to stockpile soils along the entire corridor. Most of these soils have a volcanic ash surface layer and have a moderate to high erodibility potential due to the high silt content and low rock fragment content. Stockpiling soils along entire corridors would increase the surface area of exposed soil and thereby result in more soil losses than if salvaged soils were concentrated in only a few stockpiles in clearings or areas of recent timber harvest immediately adjacent to new roads.

Alternative 2 - Soil Losses from Soil Salvage and Replacement

Soil losses during salvage and replacement activities could affect the volume of soil estimated for salvage, particularly at LAD Areas and at the Libby Adit Site where salvageable soil was limited (soils have already been salvaged and stockpiled at the Libby Adit Site). This in turn would affect proposed redistribution depths at LAD Areas and at the Libby Adit Site and could potentially adversely affect reclamation success. MMC reports that previous reclaimed disturbances with less than 18 inches of respread soil at the Libby Adit Site have demonstrated viable vegetation cover, and MMC proposes to respread 18 inches of soil at disturbances in LAD Areas requiring soil replacement.

MMC proposes to store all first-lift soils salvaged from the Little Cherry Creek Tailings Impoundment Site together, including surface soils having no or few rock fragments and high erosion potential, such as glaciolacustrine soils, with surface soils having a large amount of rock fragments. This could result in having highly erosive soils on the steep surface of the embankment of the impoundment and lead to excessive erosion of surface soils exposing less fertile subsoil and affecting long-term reclamation success on the impoundment embankment.

MMC proposes to salvage some clay-rich glaciolacustrine subsoils (>40 percent clay) at the Little Cherry Creek Tailings Impoundment Site. This soil type is poorly suited as a plant growth medium due to shrinking and swelling, surface crusting, low water infiltration, slow permeability, and high erodibility potential. If salvaged, this soil could be used as subsoil (9 to 18 inches) on top of the impoundment, or used to cover any sandy or gravelly soils exposed during impoundment site stripping and borrow excavation operations to minimize seepage from the tailings impoundment or from the Seepage Collection Pond, or to line the channel foundation for the Little Cherry Creek Diversion Channel. If this clay-rich material were used as final respread surface soil, plant re-establishment would be impeded and erosion would likely increase, especially on the tailings embankment.

In summary, MMC's proposed measures to control runoff and sedimentation and combined with some of the native surface soil and subsoil characteristics, such as rock fragment content, would help reduce erosion rates. If glaciolacustrine soils were used as surface soil on the impoundment, soil losses could affect reclamation success in the long term especially on the embankment of the impoundment for reasons discussed previously. Until vegetation ground cover reached predisturbance levels, anticipated to be in 3 to 5 years in most areas, erosion rates would be higher than before disturbance. Soil losses are not expected to affect reclamation success at other disturbances, because sufficient soil material exists to meet MMC's proposed reclamation plan, with the possible exception at LAD Areas and at the Libby Adit Site where salvageable soil was limited.

3.18.4.2.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would result in a loss of soil productivity on about 1,567 acres where soil would be salvaged. When compared to Alternative 2, Alternative 3 would result in an overall decrease in soil disturbance by 540 acres, which would include a decrease in road and pipeline disturbances by 14 acres. In addition to the fewer disturbed acres, Alternative 3 also would provide additional mitigation measures that would result in less erosion and less sedimentation to Libby Creek and its tributaries. These additional measures are described below.

On all soil stockpiles, interim seeding and mulching would be conducted incrementally as the stockpiles are being constructed and as soon as possible, regardless of season, rather than waiting until the first appropriate season after they reach design capacity. This would reduce erosion potential and potentially reduce sedimentation to drainageways.

For new roads that are to be operational for mine life, salvaged soils would be stockpiled in clearings or in areas of recent timber harvest immediately adjacent to new roads or in other nearby soil stockpiles rather than stockpiling along the entire road corridor. Consolidating soil stockpiles would improve management and control soil losses along road corridors and minimize sedimentation to nearby waterways. MMC would develop and implement a Road Management Plan addressing all roads used in the alternative. Successful implementation of the plan would ensure that erosion and sediment delivery from roads would be minimized.

A Little Cherry Creek Diversion Channel would not be needed under Alternative 3. Elimination of the Diversion Channel would reduce short-term erosion in the unnamed tributaries and sedimentation to Libby Creek. The potential long-term effects of channel aggradation and bank erosion from channel widening in Libby Creek and the potential for sedimentation and bank erosion in Bear Creek also would be eliminated. Once the tailings impoundment was reclaimed, there would be a 40 to 70 percent increase in average annual flows in Little Cherry Creek as

runoff from the impoundment surface would be directed to Little Cherry Creek. This increase in flow would cause some short-term scouring and bank sloughing in Little Cherry Creek closer to the impoundment and some sedimentation farther downstream.

For soil salvage at the Poorman Tailings Impoundment Site, rocky soil would be segregated from non-rocky soil. Soil would be replaced in two lifts 24 inches thick on the embankment and impoundment surface. Rocky subsoil would be used as respread subsoil (15 inches thick) over the tailings embankment, and rocky surface soil would be used as the upper 9 inches of respread soil on the embankment. This would minimize erosion potential on the embankment. The non-rocky surface soil would be used as the upper 9 inches of respread soil on the rest of the impoundment on slopes less than 8 percent. The clay-rich subsoil of glaciolacustrine soils salvaged from the impoundment area would be stockpiled separately from other second-lift soils and used, along with other salvaged soil, as respread subsoil (15 inches thick) on top of the tailings impoundment. It could also be used to cover any sandy or gravelly soils exposed during impoundment site stripping and borrow excavation operations to minimize infiltration of water from the tailings impoundment or from the Seepage Collection Pond.

With the modifications to control erosion under Alternative 3, soil losses within the disturbed areas would be less and not as severe as under Alternative 2 and sedimentation to waterways would be less for Alternative 3 than for Alternative 2 (section 3.18.4.2.2, *Alternative 2 – MMC's Proposed Mine*). Because there would be 571 fewer acres of soil disturbance in Alternative 3 than in Alternative 2, there would be less soil loss with Alternative 3.

3.18.4.2.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would result in 1,805 acres of potential soil disturbances at soil salvage areas (Table 133). When compared to Alternative 2, Alternative 4 would have 302 acres less soil disturbance, including 14 acres less road and pipeline disturbance (Table 133). When compared to Alternative 3, Alternative 4 would have 238 acres more of soil disturbance (Table 133). Alternative 4 would provide the same additional mitigation measures as Alternative 3, which would result in less erosion and less sedimentation to Libby Creek and its affected tributaries. MMC would develop and implement a Road Management Plan addressing all roads used in the alternative. Successful implementation of the plan would ensure that erosion and sediment delivery from roads would be minimized.

Under Alternative 4, a Little Cherry Creek Diversion Channel would be built and would consist of two main sections: an upper engineered channel and a constructed lower channel to Libby Creek using Channel A proposed in Alternative 2. The engineered channel would be the same as the engineered channel under Alternative 2 and would be designed for the 6-hour Probable Maximum Flood. It would flow into a constructed channel that would be designed to be geomorphologically stable and to handle the 2-year flow event. The natural-designed channel would have similar channel pattern, dimensions, profile, and bed material as similar sized channels in the analysis area (see design elements listed in section 2.6.2.2, *Modified Little Cherry Creek Tailings Impoundment*). A floodplain would be constructed along the channel to allow passage of the 100-year flow.

Significant erosion and sedimentation should not occur because construction of the channel would be done in dry conditions. The majority of sediment generated would occur during initial channel flush and subsequent high flow and rainfall events. In the event of heavy precipitation during construction of the channel, significant erosion may occur. Natural and biodegradable

materials and vegetation would be used along stream banks and on the floodplain to minimize erosion, stabilize the stream channel and floodplain, and minimize sedimentation to the lower channel and Libby Creek. Long-term monitoring and maintenance would be required, if necessary, until the lead agencies determine that the channel was stabilized. Even with these mitigation measures, the constructed natural-designed channel would be subject to erosion and sedimentation during construction and until vegetation stabilizes the stream banks and floodplain. Short-term increases in sedimentation to the lower channel and Libby Creek would likely occur as a result.

Following reclamation of the impoundment, the constructed channel would undergo an additional period of channel adjustment when runoff from the impoundment surface was directed to the Diversion Channel. The increase in flow would be about 50 percent higher than during operations, and would lead to new channel adjustments. This would likely cause short-term increases in sedimentation in the lower channel and Libby Creek.

For soil salvage at the Alternative 4 Little Cherry Creek Tailings Impoundment, rocky surface soil would be segregated from non-rocky surface soil. Like Alternative 3, rocky subsoil would be used as respread subsoil (15 inches thick) over the tailings embankment, and rocky surface soil would be used as the upper 9 inches of respread soil on the embankment. This would minimize erosion potential on the embankment. Non-rocky surface soil would be used as the upper 9 inches of respread soil on the rest of the impoundment on slopes less than 8 percent. Also like Alternative 3, clay-rich subsoil of glaciolacustrine soils salvaged from the impoundment area would be stockpiled separately from other second-lift soils and would be used, along with other salvaged soil, as respread subsoil (15 inches thick) on top of the tailings impoundment. It could also be used to cover any sandy or gravelly soils exposed during impoundment site stripping and borrow excavation operations to minimize infiltration of water from the tailings or from the Seepage Collection Pond, or to line the channel foundation for the Little Cherry Creek Diversion Channel.

With the modifications to control erosion under Alternative 4, soil losses within the disturbed areas would be less and not as severe as Alternative 2 and sedimentation to waterways would be less for Alternative 4 than for Alternative 2 (section 3.18.4.2.2, *Alternative 2 – MMC's Proposed Mine*). Because Alternative 4 would have 302 fewer acres of soil disturbance than Alternative 2, there would be less soil loss under Alternative 4 (Table 133). Compared to Alternative 3, Alternative 4 would have more soil loss because there would be 238 acres more of soil disturbance (Table 133)

3.18.4.2.5 Transmission Line Alternatives

Alternative A – No Transmission Line

Under Alternative A, the transmission line and substation for the Montanore Project would not be built. Soil erosion losses due to water and wind would continue at natural rates. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

Alternative B – North Miller Creek Alternative

MMC's proposed North Miller Creek transmission line corridor would be 16.4 miles long and would require 109 structures. This alternative is slightly longer than the lead agencies' alternatives in part because it ends at the substation at the Ramsey Plant Site where the lead agencies' alternatives end at the substation at the Libby Plant Site about 1.5 miles to the east. Of the four alternatives. The centerline of the transmission line of the North Miller Creek Alternative would cross more steep areas (7.4 miles), more soils with a severe erosion hazard (6.7 miles), and more soils with high sediment delivery (5.1 miles) than the other three alternatives. The disturbance associated with structure placement would increase erosion until vegetation ground cover around the structure locations reached predisturbance vegetation ground cover levels. MMC did not specify the type of logging that would be used. For analysis purposes, the lead agencies assumed all logging would be completed conventionally without the use of a helicopter. Disturbance associated with logging operations would increase soil erosion.

The primary surface disturbance from transmission line construction would be construction of new access roads. The total disturbance for access roads, which would be either new roads or closed roads requiring upgrades, would be greater under this alternative (30.9 acres) than the other alternatives. The access roads would disturb 8.9 acres of soil having severe erosion risk, 6.3 acres of soil having high sediment delivery potential to waterways, 13.3 acres of soil having potential for slope failure, and 16.5 acres of slopes greater than 30 percent (Table 134). Disturbances on steeper slopes are generally more difficult to reclaim and require more mitigation measures than on shallower slopes. The majority of soils having severe erosion risks along access roads occur along Libby and Miller creeks and Fisher River. Most soils with high sediment delivery potential disturbed by access roads occur along Ramsey, Libby, and Miller creeks and Fisher River. Most soils having potential for slope failure occur along Ramsey Creek, just east of Libby Creek, and near Fisher River. Access roads on slopes exceeding 30 percent primarily occur along Ramsey Creek, between Libby and Miller creeks, north of Miller Creek, and locations east of the Fisher River (Figure 82).

Sediment controls and BMPs would be implemented on new and upgraded roads during construction of the transmission line to minimize erosion, sediment delivery to waterways, and slope failure. All access roads, after construction of the transmission line but during the life of the project, would be closed and placed into intermittent stored service and reclaimed with interim reclamation designed to stabilize the surface. This reclamation would include removal of drainage obstructions at road crossings, reseeding the road surface, and where soil had been salvaged from new roads, the road surface would be covered with soil and then reseeded.

After the transmission line was removed, all newly constructed roads on National Forest System lands would be decommissioned. They would be recontoured to match existing topography, obliterating the road prism, and reseeded. Where culverts were removed, stream banks would be recontoured and reseeded. Final closure status of new access roads on private lands would be based on the landowner's discretion. With sediment controls, BMPs and short duration of exposed soil, there would be no severe reclamation constraints, no significant adverse impacts to the soil resources, and the soil losses along access roads would likely be minor until vegetation was re-established in most areas after 3 to 5 years. Vegetation re-establishment on steep areas, particularly on south- and west-facing slopes, would take longer.

Table 134. Comparison of Physical Characteristics and Erosion Risks for Transmission Line Alternatives.

Criteria	Units	Alternative B – North Miller Creek	Alternative C – Modified North Miller Creek	Alternative D – Miller Creek	Alternative E – West Fisher Creek
Total length of Transmission Line	Miles	16.4	13.4	14.1	14.9
Total road disturbance[†]	Miles	10.2	3.0	3.3	4.2
	Acres	30.9	9.1	10	12.7
Severe erosion risk					
Centerline only	Miles	6.7	3.7	5.2	3.7
New roads + closed roads with high upgrade requirements	Acres	8.9	4.2	4.2	3.1
High sediment delivery					
Centerline only	Miles	5.1	1.1	1.1	0.4
New roads + closed roads with high upgrade requirements	Acres	6.3	1.5	1.5	0.5
Slope failure					
Centerline only	Miles	9.3	6.4	7.9	9.2
New roads + closed roads with high upgrade requirements	Acres	13.3	3.6	3.7	7.4
Slopes > 30 percent					
Centerline only	Miles	7.4	5.2	2.9	3.4
New roads + closed roads with high upgrade requirements	Acres	16.5	2.1	1.3	2.1

[†]Does not include new roads within the transmission line right-of-way.

Source: GIS analysis by ERO Resources Corp. using vegetation mapping in USDA Forest Service and Natural Resources Conservation Service 1995.

Alternative C – Modified North Miller Creek Alternative

The Modified North Miller Creek Alternative would be 13.4 miles long, require 80 structures, and end at the substation at the Libby Plant Site, which is about 1.5 miles east of the proposed substation at the Ramsey Plant Site under Alternative B. The centerline would cross 5.2 miles of steep slopes, 3.7 miles of soils with severe erosion risk, and 1.1 miles of soils with high sediment delivery. The disturbance associated with structure placement would increase erosion until vegetation ground cover around the structure locations reached predisturbance vegetation ground cover levels. MMC would use a helicopter to harvest timber, reducing the need for access roads (Figure 45). Conventional logging techniques would be used in other areas. Helicopter logging would result in less soil erosion than conventional logging used in Alternative B.

New access roads and closed roads with high upgrade requirements would be needed for transmission line installation and would create 9.1 acres of disturbance, the fewest of all alternatives and about 22 acres fewer than Alternative B. These roads would disturb 4.2 acres of

soils having severe erosion risk, 1.5 acres of soils with high sediment delivery potential to waterways, 3.6 acres of soil that have potential for slope failure, and 2.1 acres of slopes greater than 30 percent. Most soils having severe erosion risks along access roads occur along Libby Creek in the extreme western portion of the transmission line, and along Miller Creek and Fisher River. Soils having high sediment delivery potential along access roads occur along Libby and Miller creeks and at the northeast end along the Fisher River. Most soils having potential for slope failure along access roads occur just east of Libby Creek, along Miller Creek, and east of Fisher River. Access roads on slopes exceeding 30 percent occur primarily between Libby and Miller creeks, north of Miller Creek, and along portions east of Fisher River (Figure 82). MMC would develop and implement a Road Management Plan addressing all roads used in the alternative. Successful implementation of the plan would help minimize erosion and sediment delivery from roads.

Sediment controls and BMPs would be implemented on new roads to minimize erosion, sediment delivery to waterways, and slope failure. As with Alternative B, new access roads on National Forest System lands would be placed into intermittent stored service after line construction was completed. Intermittent stored service roads would be closed to traffic and would be treated, which would include at a minimum removing drainage obstructions, replacing salvaged soil, seeding, and installing cross drains, so they would cause little resource risk if maintenance were not performed on them during the operation period of the mine and prior to their future need. Intermittent stored service is described in section 2.9.3.2, *Access Road Construction and Use*.

After removal of the transmission line, decommissioning transmission line roads on National Forest Systems lands would be similar as under Alternative 2. The road prism would be obliterated, all watercourses would be restored, and the road prism would be revegetated. Road decommissioning is described in section 2.9.3.2, *Access Road Construction and Use*. Unlike Alternative B, for Alternative C, the surface soil that had been in place on access roads for the life of the transmission line would be salvaged, the road prism obliterated, and then the surface soil replaced. The surface soil that had been in place for the life of the transmission line would have higher nutrient levels, higher organic matter content, and greater microbial activity than the underlying soil, and it would be a seed source for the native plants that had established over the life of the transmission line. This would shorten the amount of time for vegetation to re-establish, which would minimize the amount of time bare soil was exposed to erosive forces.

Newly constructed roads on Plum Creek lands would be gated after construction and managed as proposed by MMC in Alternative B. As with Alternative B, final closure status of new access roads on private lands would be based on the landowner's discretion. With fewer acres of disturbance and the shorter amount of time soil was exposed, impacts probably would be lower than those on Alternative B. With sediment controls, BMPs and short duration of exposed soil, there would be no severe reclamation constraints, no significant adverse impacts to the soil resources are expected, and the soil losses along access roads would likely be minor until vegetation was re-established in 3 to 5 years for most areas. Vegetation re-establishment on steep areas, particularly on south- and west-facing slopes, would take longer.

Alternative D – Miller Creek Alternative

The Miller Creek Alternative would be 14.1 miles long, require 95 structures, and end at the substation at the Libby Plant Site. This alternative would cross the least amount of areas of steep slopes (2.9 miles). Erosion and sediment delivery associated with structure placement would be

slightly more than Alternative C, and less than Alternative B (Table 134). Some areas would be logged using a helicopter, resulting in disturbances and erosion similar to Alternative C.

New access roads and closed roads with high upgrade requirements would create 10 acres of disturbance (about 21 fewer acres than Alternative B), and disturb 4.2 acres of soils having severe erosion risks, 1.5 acres of soils with high sediment delivery potential to waterways, and 3.7 acres of soil that have potential for slope failure. Access roads for this alternative would cross the fewest acres of slopes that exceed 30 percent (1.3 acres). Most soils having severe erosion risks along access roads occur along Libby Creek in the extreme western portion of the transmission line, along Miller Creek and Fisher River. The majority of soils with high sediment delivery potential along access roads occur along Libby and Miller creeks and at the northeast end along the Fisher River. Most soils having potential for slope failure along access roads occur southeast of Libby Creek near Howard Lake, along Miller Creek, and east of Fisher River (Figure 82). Other effects and measures to control soil losses associated with the transmission line and corresponding access roads would be the same as Alternative C.

Alternative E – West Fisher Creek Alternative

The West Fisher Creek Alternative would be 14.9 miles long, require 101 structures, and end at the substation at the Libby Plant Site. The centerline would cross 3.4 miles of steep areas, similar to Alternative D. Erosion associated with structure placement would likely be the lowest in Alternative E, which would cross 3.7 miles of soils with severe erosion risk, and 0.4 mile of soils with high sediment delivery. Some areas would be logged using a helicopter, resulting in disturbances and erosion similar to Alternative C.

New access roads and closed roads with high upgrade requirements would create 12.7 acres of disturbance (about 18 fewer acres than Alternative B), and would disturb 3.1 acres of soils having severe erosion risks, which occur primarily along Libby and West Fisher creeks and Fisher River. This alternative would affect few soils with high sediment delivery potential (0.5 acre), and would affect 7.4 acres of soils with a potential for slope failure, which occur southeast of Libby Creek near Howard Lake, north of West Fisher Creek, and east of Fisher River. Access roads would cross 2.1 acres having slopes greater than 30 percent, which occur primarily along portions north of West Fisher Creek and along portions east of Fisher River (Figure 82). Other effects and measures to control soil losses associated with the transmission line and corresponding access roads would the same as Alternative C.

3.18.4.3 Soil Physical, Biological, and Chemical Characteristics

Soil characteristics that would be impacted by action Alternatives 2, 3, and 4 include changes in soil physical properties, biological activity, and nutrient levels. The likelihood of changes in chemical properties such as changes in heavy metal concentrations and soil pH are also discussed.

3.18.4.3.1 Alternative 1 – No Mine

Under Alternative 1, the Montanore Project would not be developed. Soil changes in physical and chemical properties, biological activities, and nutrient levels would be limited to any existing exploration-related or baseline collection disturbances. All existing exploration-related or baseline collection disturbances by MMC would be reclaimed in accordance with existing laws and permits. In all other areas, soil changes in physical and chemical properties, biological activities, and nutrient levels would continue at natural rates.

3.18.4.3.2 Alternative 2 – MMC Proposed Mine

Alternative 2 - Physical Characteristics

Single lift soil salvage and replacement would alter the natural soil profile by mixing soil horizons that developed over the past 10,000 years. MMC would use the single lift salvage and replacement method at the Ramsey Plant Site, the Libby Adit Site, the LAD Areas, and access roads. The Little Cherry Creek Tailings Impoundment Site would have soils salvaged and replaced in two lifts. This would limit impacts from mixing soil horizons but the loss of soil development and the length of time to re-establish a new soil profile would still take a long time. Other disturbances where soils would be salvaged using a two-lift method, the soils would be replaced using a single-lift method. There would be a long-term impact to the soil profile at these sites. Over time, natural processes would rebuild a new soil profile that may or may not resemble the predisturbance condition. The loss of soil development and the time needed to redevelop a new soil profile would be an unavoidable impact of soil disturbance.

To minimize soil compaction, MMC would rip compacted areas before redistribution of soil. Areas expected to be ripped include the adit portal areas, roads, soil stockpile sites, the dam face of Little Cherry Creek Tailings Impoundment, and facility areas. Ripping also would eliminate potential slippage at layer contacts and promote root growth. Following soil redistribution, the seedbed would be disked and harrowed on slopes 33 percent or less, which would minimize compaction of the seedbed. These practices would tend to offset compaction on many reclaimed sites. Some areas, such as road fills and as much as possible at the tailings impoundment site, would receive direct-hauled soil. If seeded immediately, and provided that soils are handled when dry, compaction would be minimal. MMC has not committed to handle soils when dry. If soils were wet when handled, some compaction would be expected, especially on slopes greater than 33 percent because the seedbed on these slopes would not be disked and harrowed. The establishment of vegetation, root systems, rodent activity, and physical processes such as freezing and thawing, and wetting and drying would decrease soil compaction. In time, effects related to soil compaction of respread soils would be reduced.

Alternative 2 - Biological Activities

The loss of organic matter and mycorrhizae in soils stockpiled for prolonged periods could lower plant species diversity (Reeves *et al.* 1979 In USDA Forest Service and DEQ 2001). If mycorrhizae-inoculated trees and shrubs species were readily available, MMC would use these species and would use stock raised in containers where the soil medium has been inoculated with mycorrhizae, if it were available. The loss of organic matter and mycorrhizae would be a long-term impact, and if mycorrhizae inoculation were not completed, the long-term survival and growth of woody species, in particular, may be reduced. In time, mycorrhizae would invade reclaimed sites from adjacent undisturbed areas, and species diversity would eventually increase, but not to pre-mine levels as discussed in section 3.21.1.4, *Environmental Consequences* of section 3.21, *Vegetation*.

Alternative 2 - Soil Nutrients

As is typical of many forest soils, nutrient levels are low to very low partially due to low soil pH. During soil storage, these levels would only decrease as organic matter and biological activity decreased and precipitation leached nutrients through the stockpiles. Soil stockpiles would contain organic debris, such as residual coniferous forest slash that was acidic, that could decrease soil pH as the material weathers.

Soils formed in volcanic ash often fix phosphorus in a form unavailable for plant uptake (Jones *et al.* 1979 *In* USDA Forest Service and DEQ 2001). Organic matter in the upper few inches of native soils acts as a reservoir for phosphorus. Plant-available phosphorus is released by microbial decomposition within and directly below the forest litter layer. Replaced soils would lack organic matter, as explained above; therefore, surface applications of soluble phosphorus fertilizer at the time or prior to seeding, as proposed by MMC, may be of little value. MMC has proposed to apply organic matter in the form of straw mulch, which has little nutrient value, and wood mulch may be used if straw mulch proved to be ineffective for successful reclamation. MMC would test areas with poor plant germination and/or growth to determine causes of unsuccessful revegetation and then take corrective actions. This would help offset organic matter and/or phosphorous deficiencies.

MMC proposes to salvage equal volumes of first-lift soils and second-lift soils at borrow sites C and D. In doing so, MMC may not necessarily segregate the most suitable soil that would be used as the upper 9 inches of respread soil. Mixing surface soil with subsoil would reduce organic matter content in first-lift replaced soils, which would affect availability of essential nutrients. This may also affect the success of plant re-establishment unless additional organic matter was applied to these areas. The same would be true with using single-lift soil salvage and replacement method at the sites mentioned above. This would mix soil horizons and thereby reduce organic matter content in first-lift replaced soil at these sites.

To minimize these impacts, MMC would complete soil tests prior to seeding to determine the appropriate fertilizer rates required for successful reclamation. Fertilizer and mulch would be applied on respread soils at the time and prior to seeding, and nitrogen fertilizer would be broadcasted over the soil surface after seeding early in the subsequent growing season. MMC's proposed soil testing program to identify fertilizer and other possible soil amendment needs, and taking corrective actions in areas of poor plant growth would help offset nutrient deficiencies in respread soils in the short term, and then when vegetation became re-established and soil building processes began on reclaimed areas, nutrient levels would eventually reach predisturbance levels.

Alternative 2 - Chemical Characteristics

Seeps from soil stockpiles in forested regions in other parts of Montana have indicated elevated levels of iron and manganese (USDA Forest Service and DEQ 2001). The levels of tannic acids increase and soil pH is reduced due to the breakdown of coniferous forest vegetation in the stockpiles. Low pH and increased levels of iron and manganese can result in complex nutrient deficiency and/or phytotoxicity problems in many plant species (Knezek and Ellis 1980 *In* USDA Forest Service and DEQ 2001; Kabata-Pendias and Pendias 1984 *In* USDA Forest Service and DEQ 2001). Reduced plant growth and/or mortality would slow or severely impair reclamation. Applications of composted organic matter have helped improve plant growth on reclaimed sites with affected soils (Vodehnal 1993 *In* USDA Forest Service and DEQ 2001). MMC has proposed to apply straw mulch but would test areas with poor plant germination and/or growth to determine causes of unsuccessful revegetation and then take corrective actions.

3.18.4.3.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

To better preserve the natural soil profile, double-lift soil salvage and replacement would be used at most disturbances, including the Poorman Tailings Impoundment Site, Libby Plant Site, LAD Areas, and along access roads that already had been cleared areas to store additional soil or that are near other soil stockpile areas, Single-lift salvage and replacement would be used along road

segments that do not have existing cleared areas large enough to store two lifts of soil or that are not near other soil stockpile areas. Where single-lift salvage and replacement would be used for access roads, the soil profile on reclaimed access roads would be more severely impacted and require more time to rebuild than at areas reclaimed using double-lift soil replacement method. Over time, natural processes would rebuild a new soil profile that may or may not resemble the predisturbance condition. The loss of soil development and the time needed to redevelop a new soil profile would be an unavoidable impact of soil disturbance.

To minimize compaction, all salvaged soils would be handled at the low moisture content, and all disturbed areas that have been resoiled and are to be seeded would be scarified to a depth of 6 to 12 inches prior to seeding to minimize compaction and improve seed establishment. The entire tailings impoundment and severely compacted areas, such as roads, soil stockpile sites, and facility sites would be ripped up to 18 inches deep with dozer ripping teeth prior to soil replacement to reduce compaction and break up surface crust to facilitate water infiltration and enhance rooting depth. Soil compaction would be short-term in all disturbed areas with these mitigation measures, and following reclamation compaction in respread soils that are ripped would be similar to pre-mine soils.

Where redistributed soils cover non-native material, such as the entire Poorman Tailings Impoundment and if any waste rock storage areas remained at the end of mining, an average of 24 inches of soil would be replaced in two lifts to provide sufficient rooting depth. Other reclaimed sites in Montana have shown that 24 inches of respread soil provides sufficient rooting depth (Plantenberg, pers. comm. 2006).

To promote the rebuilding of mycorrhizae in areas where trees are to be planted in respread soils that have been stored for prolonged periods, either an agencies-approved wood-based mulch would be incorporated into the upper 4 inches of respread soil (Plantenberg, pers. comm. 2006), and/or inoculated tree-planting stock with the appropriate mycorrhizal fungi would be used, or mycorrhizal fungi would be incorporated into the soil as pellets during seeding.

As mentioned earlier, organic matter in the upper few inches of native soils acts as a reservoir for phosphorus, and replaced soils that were stored for prolonged periods would lack organic matter. To enhance phosphorus and other nutrient levels and to increase organic matter levels, the upper 4 inches of respread soil would be amended with an agencies-approved wood-based organic amendment before planting. This would stimulate the development of fungal based mycorrhizae in the new soil.

Because of the observed metal leaching and low pH problems from soil stockpiles containing large amounts of coniferous vegetation at other mine sites in Montana, most coniferous forest debris would be removed before soil salvage. This also would minimize soil nutrient losses, because low pH conditions can result in complex nutrient deficiency and/or phytotoxicity problems.

The additional mitigation measures of Alternative 3 for limiting the total loss of the natural soil profile, soil compaction, loss of soil biological activity, and reduction of nutrient levels would reduce the severity of these impacts when compared to Alternative 2. In addition, these measures would enhance reclamation success more than Alternative 2 would.

3.18.4.3.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Modifications for Alternative 4 would be similar to the modifications in Alternative 3. The effects of these modifications would be similar as well. The difference would be the tailings impoundment would be at the same location as for Alternative 2, and 24 inches of soil would be respread over the entire Little Cherry Creek Tailings Impoundment including the top of the impoundment.

As with Alternative 3, to better preserve the natural soil profile, double-lift soil salvage and replacement would be used at most disturbances, including the same disturbances as Alternative 3 but also at the Little Cherry Creek Tailings Impoundment Site and the Little Cherry Creek Diversion Channel. Single-lift salvage and replacement would be used for some roads segments as Alternative 3.

3.18.4.3.5 Transmission Line Alternatives

Alternative A – No Transmission Line

In Alternative A, the transmission line and substation for the Montanore Project would not be built. Soil changes in physical and chemical properties, biological activities, and nutrient levels would continue at natural rates. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

Alternative B – North Miller Creek Alternative

Changes in physical properties of the soils due to handling under the North Miller Creek Alternative would be similar to those listed in section 3.18.4.1, *Effects Common to All Action Alternatives*. The natural soil profile would be altered, there would be a loss of soil pore space (an increase in compaction), and a loss of organic matter due to mixing. Most of these changes in the soil (except alteration of the soil profile) would be short-term, in part because all access roads would have soil replaced (if soil were removed) and would be reseeded immediately following transmission line completion. Additionally, protective vegetation on road surfaces would establish more quickly because soils stockpiled for short durations are still biologically active and retain a higher level of favorable physical and chemical characteristics than soils stored for prolonged periods. To minimize soil compaction, MMC would rip access roads, if necessary, when no longer needed. Following soil replacement, the seedbed would be disked and harrowed, which would minimize compaction of the seedbed.

Soils would be salvaged in a single lift for new access roads and for some existing roads altering the natural soil profile that developed over thousands of years. The establishment of vegetation, root systems, and physical processes, such as freezing and thawing, and wetting and drying, would help rebuild a new soil profile, but this would be a long-term impact and would require a long time.

Alternative C – Modified North Miller Creek Alternative

Changes in physical, chemical and biological properties of the soils due to handling from road construction and interim reclamation under the Modified North Miller Creek Alternative would be similar to those listed under the North Miller Creek Alternative.

Because with final reclamation, the surface soil that had been in place for the life of the transmission line would be salvaged and then replaced after the road prism was obliterated, changes in physical and biological properties of the soils due to handling under the Modified North Miller Creek Alternative would be less than under the North Miller Creek Alternative. The natural soil profile would still be altered but not as severely, there would still be a loss of soil pore space (an increase in compaction), the loss of organic matter would be reduced due to less mixing of the soil, and the soil biological activity would be less affected. This would shorten the time to re-establish vegetation and for successful reclamation. The better soil handling methods and the fewer acres of disturbance under the Modified North Miller Creek Alternative (Table 134) would reduce the effects of impacts when compared to the effects in the North Miller Creek Alternative.

Alternative D – Miller Creek Alternative

Changes in physical, chemical, and biological properties of the soils due to handling in the Miller Creek Alternative would be similar to Alternative C.

Alternative E – West Fisher Creek Alternative

Changes in physical, chemical, and biological properties of the soils due to handling in the West Fisher Creek Alternative would be similar to Alternative C.

3.18.4.4 Reclamation Success

Factors important to successful reclamation include soil salvage and handling, vegetation removal and disposition, revegetation, and success criteria.

3.18.4.4.1 Alternative 1 – No Mine

Under Alternative 1, the Montanore Project would not be developed. Reclamation would be limited to any existing exploration-related or baseline collection disturbances. All existing exploration-related or baseline collection disturbances by MMC would be reclaimed in accordance with existing laws and permits.

3.18.4.4.2 Alternative 2 – MMI Proposed Mine

MMC's reclamation goal is to establish a post-mining environment compatible with existing and proposed land uses and consistent with the KFP. Specific goals of reclamation serve a number of purposes as described in MMC's reclamation plan (MMC 2007).

Alternative 2 - Soil Salvage and Handling

Table 133 presents a comparison of the likely disturbances in which soil would be salvaged and salvageable soil volumes of mine facilities for each alternative. The table shows salvageable volumes for first lift and second lift soil. Even though MMC proposes to use double-lift salvage at the Little Cherry Creek Diversion Channel and other potential disturbances within the Little Cherry Creek Tailings Impoundment, they do not propose to use a double-lift replacement at these sites. These second-lift soils would only be used on the tailings impoundment.

MMC proposes to redistribute 24 inches of soil on the embankment of the Little Cherry Creek Tailings Impoundment using a double-lift salvage and replacement method. Replaced soil depths on other disturbed areas would be 18 inches including the top of the tailings impoundment. The double-lift salvage and replacement would provide enhanced soil physical and chemical properties in the reclaimed surface soil layer. First-lift soils would have more favorable conditions for revegetation establishment, such as higher organic matter content, higher nutrient levels, and

better soil structure, which has higher porosity that facilitates plant root development. This practice attempts to salvage and replace some of the natural soil profile characteristics that developed on the site since the last major climatic change.

Total soil disturbance of the Little Cherry Creek Tailings Impoundment would be 620 acres (Table 133). Soils in the impoundment area, in part, would be replaced based on soil erodibility and slope steepness. For example, the least erodible colluvial/glacial soils having the greatest rock fragment content would be used as subsoil (15 inches thick) on the embankment of the impoundment to minimize erosion potential. Rock fragments reduce the erodibility of soils by anchoring the surface. First-lift soils, would consist of both rocky and non-rocky surface soils, and would be used as surface soil over the entire impoundment including the embankment. Soil replacement on the embankment would be in two lifts; 15 inches of rocky subsoil on bottom followed by 9 inches of surface soil on top. Over the rest of the impoundment MMC proposes soil replacement in two lifts; 9 inches of second-lift soil followed by 9 inches of first-lift soil. If MMC did not use rocky soil for the upper 9 inches on the tailings embankment, erosion of the surface may occur and exposed the less fertile subsoil. If this happened, successful reclamation on the tailings embankment may not be achieved.

The tailings material would be composed of sands and silts that would not be phytotoxic (lethal or damaging to plants). It is likely that this material, especially the silts, would become hard and compacted upon drying. Without scarification or deep ripping before soil placement, this fine tailings material could become an effective barrier to root penetration and could affect long-term establishment of deep rooted plants such as trees and shrubs. Because tailings on the dam face would be coarser and because MMC proposes to deep rip the dam face before soil placement, a physical rooting barrier on the dam face would not be an issue.

Material below salvageable soil depths from borrow areas that occur outside the footprint of the Little Cherry Creek Tailings Impoundment would be used for construction on portions of the Saddle Dams, Starter Dam, Seepage Collection Dam, or toe dike. These borrow areas would create about 419 acres of disturbance (Table 133), and have an average of 14 inches of salvageable soils. About 277 acres of soil in this area have not been mapped at a site-specific intensive level. In addition, about 43 acres of soil in other disturbances in the impoundment area and 139 acres of road disturbance requiring soil salvage and replacement have not been mapped at an intensive level. Not mapping the soils at an intensive level before salvage may result in not salvaging all suitable soil and/or salvaging some unsuitable soils, such as soils having low pH conditions. If unsuitable soils were used as respread soils, plant establishment may be adversely affected.

The total disturbance for the Ramsey Plant Site would be 52 acres. Salvageable soil depths at the site are about 24 inches, of which MMC proposes to salvage 18 inches in one lift. The total disturbances for the Little Cherry Creek Diversion Channel would be 40 acres. Salvageable soil depths along the Diversion Channel are about 13 inches, of which MMC proposes to salvage about 9 inches in one lift. The total disturbance from roads would be about 149 acres, on which MMC proposes to salvage and replace soils in one lift. Not utilizing the double-lift salvage and replacement method would mix the relatively organic-rich and nutrient-rich surface soil layer with the poorer quality subsoil layer and place more unproductive soil on the surface. Again, plant establishment may be reduced and could take longer for reclamation success to be achieved.

The total soil disturbance for the LAD Areas 1 and 2 would be 31 acres. The disturbed areas at the LAD Areas would include ponds, embankments, ditches, soil stockpile areas, and access roads. LAD Area 1 also would include a waste rock disposal area. LAD Area disturbances would require soil salvage (except soil stockpile areas) and reclamation. The larger areas used for land application and disposal would require only selective thinning of trees, access road construction, and little soil removal. Salvageable soil depths at LAD Areas average about 9 inches, but MMC would respread 18 inches of soil over the disturbances at LAD Areas. Some soil likely would be hauled from elsewhere to compensate for the shortage of salvaged soil at LAD Areas. Impacts to reclaimed disturbances at the LAD Areas would be the same as other areas not having a double-lift soil replacement.

Many of the impacts resulting from soil salvage and handling would be moderate in the long term for comparable stability and utility determinations. Long-term effects could occur on the embankment of the Little Cherry Creek Tailings Impoundment if surface erosion occurred and exposed subsoil. Long-term effects could occur on the top of the impoundment if the surface were not ripped to break up any rooting barriers, at areas where unsuitable soils may be used, and at areas where the double-lift soil replacement were not used.

Alternative 2 - Vegetation Removal and Disposition

MMC has not proposed any special plan to deal with vegetation removal and disposition other than harvesting trees and burning slash. This may result in the loss of a source of native plant materials, less organic debris that could be used for BMPs, and loss of potential non-coniferous organic enrichment in stockpiled soils. Opportunities to enhance reclamation success could be lost. If too much coniferous forest debris were left on the soil and salvaged with the soil, soil pH in the stockpiles could be reduced.

Alternative 2 - Revegetation and Success Criteria

MMC has developed two final seeding/planting mixes to accommodate the differences in disturbance areas and an interim seed mix (MMC 2007). These mixes would be dominated by native species; some introduced species would be included. Introduced species may hinder colonization of native species and could spread off the reclaimed areas. Prior to reclamation, MMC would submit seed mix information to the lead agencies, so that the agencies would have an opportunity to adjust seed mixes as appropriate for site conditions and to meet any KFP changes. If the agencies required removal of introduced species from seed mixes, the adverse long-term effects that introduced plant species would have on reclaimed sites and surrounding areas would be reduced.

Trees and shrubs would be planted on steeper slopes of the Little Cherry Creek Tailings Impoundment throughout the project life as areas were reclaimed, on cut-and-fill slopes at the Ramsey Plant Site, the Libby Adit Site, and portions of LAD Areas. MMC would plant trees and shrubs at the end of operations on all other disturbances including the top of the impoundment and waste rock dumps, if present at the end of operations. Trees and shrubs would not be planted on the Rock Lake Ventilation Adit, soil stockpile sites, portal patios, and along road corridors. In these areas, reforestation would occur by natural regeneration. This approach would increase the time needed to achieve a natural looking setting, to provide screening, and to achieve important wildlife habitat components. A well-established grass cover in these areas likely would retard the establishment of volunteer trees. It may take up to 20 years for settling to stop and to complete

redistributing soil on top of the tailings impoundment. Delaying tree and shrub planting on top of the tailings impoundment would delay development of wildlife habitat.

MMC's proposed 18 inches of respread soil on top of the tailings impoundment, rather than 24 inches, and not ripping the tailings surface to break up surface crusting before soil placement may hinder tree root growth and overall growth rates likely would decline. Root systems would eventually penetrate the tailings, but the mass of roots likely would be concentrated in the upper 18 inches of soil, resulting in slower growing and possible stunted trees over time, and trees would likely be more prone to wind throw.

MMC proposes to plant 435 trees per acre; based on a survival rate of 65 percent, the final anticipated stocking rate after 15 years would be about 283 trees per acre. Shrubs would be planted at a rate of 200 stems per acre. The proposed planting rates may not meet overall wildlife or density recommendations by the agencies, and would require many years before stem densities on reclaimed sites have similar densities to that of surrounding landscapes.

The proposed planting plan includes the spacing of trees and shrubs to be continuous on slopes in strips alternating with strips that would be seeded with an herbaceous understory mixture, or would be spaced in randomly placed groupings on level to gently sloping areas. Planting in alternating strips would not match surrounding landscape features, would not meet visual quality objectives and may allow for noxious weed establishment along the planting strips.

If feasible, MMC would consider collecting seed or plant materials onsite to ensure the genetic adaptation of planting stock to local environmental conditions, and inoculating soils used for planting trees and shrubs with mycorrhizae. This would enhance the chances for survival, growth, and reproduction, which are necessary for long-term successful reclamation.

In summary, MMC's revegetation plan may affect long-term reclamation success and results. Potential effects include the introduction of non-native plant species, extended establishment time for trees and shrubs in some areas, and reduced woody plant densities. The potential for the spread of noxious weeds may also increase.

Part of MMC's reclamation goals include revegetation success criteria, which are anticipated to be met after a 3 to 5 year monitoring period. These success criteria include:

- Total plant cover would be at least 80 percent of the total cover of a specific control site or would meet a 70 percent total cover basis with at least 60 percent consisting of a live plant community
- There would be no more than three acceptable plant species that dominate a site based on the seed mix or natural plant community in the area, and noxious weeds would not be more than 10 percent of the plant community
- There would be no rills and gullies greater than 6 inches deep and/or wide

If any success criterion were not met after 3 years of monitoring, MMC would access the problems and correct any deficiencies of seed types, techniques or methods and take corrective measures. This process would continue until all revegetation goals were met.

3.18.4.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Short- and long-term reclamation objectives would remain the same as for Alternative 2. Modifications and their effects to soil salvage and handling, vegetation removal and disposition, revegetation, and success criteria are discussed below.

Alternative 3 - Soil Salvage and Handling

Soil would be salvaged and replaced in all disturbed areas, with the exception of soil stockpile areas, slopes greater than 50 percent, and cut slopes in consolidated material. Where redistributed soils cover non-native material such as the entire Poorman Tailings Impoundment and waste rock piles (if remaining at end of mine life), the replaced soil depth would average 24 inches using two lifts. This would produce soil depths more comparable to pre-mine conditions and would increase the likelihood of successful revegetation. Research generally has shown that replacement of 24 inches of soil over suitable mine waste rock would produce maximum revegetation (Coppinger *et al.* 1993 *In* USDA Forest Service and DEQ 2001). At all other disturbances, soil replacement depths would average 18 inches. Double lift salvage and replacement also would occur at all disturbances requiring soil salvage and replacement except for some road segments and at the Upper Libby Adit, which would have 1 acre of disturbance and there would be no suitable second-lift soil. Double-lift soil salvage and replacement would be used along access roads that already have cleared areas to store additional soil or that are near other soil stockpile areas, To minimize disturbance size and tree removal, single-lift salvage and replacement would be used along road segments that do not have existing cleared areas large enough to store two lifts of soil or that are not near other soil stockpile areas. The lead agencies would identify road areas where double-lift soil salvage and replacement would be appropriate. Reclamation would be enhanced by salvaging some soils to greater depths to provide sufficient salvageable soil volumes to achieve the soil replacement goals for all potential disturbances.

About 49 acres of soil at Borrow Area 2 and the potential rock borrow area, all soils at the Libby Plant Site (104 acres), about 183 acres of soil at other potential disturbances within the Poorman Tailings Impoundment Site, and about 125 acres of soil along roads have not been mapped at an intensive, site-specific level. Before any soils would be salvaged, intensive soil surveys would be conducted in these areas to ensure the most suitable soil and necessary volumes of soil were salvaged.

Other modifications of soil salvage and handling have been discussed in section 2.5.3.2, *Vegetation Clearing and Soil* Salvage *and Handling Plan*. These other modifications along with thicker soil replacement depths at most disturbances, and the most suitable soil and maximum volumes would be salvaged, would help to assure both short-term and long-term successful revegetation.

Alternative 3 - Vegetation Removal and Disposition

As described in section 2.5.3.2.1, *Vegetation Removal and Disposition*, a Vegetation Removal and Disposition Plan that would evaluate the potential uses of vegetation removed from areas to be disturbed and would describe disposition and storage plans during mine life would be prepared. This plan would result in the maximum use of native plant materials and organic debris for BMPs to enhance reclamation success. Where possible, slash of non-coniferous forest debris from timber-clearing would be salvaged and chipped to be used as mulch or as an additive to stored surface soil stockpiles. Because of the observed metal leaching from soil stockpiles containing

large amounts of coniferous vegetation at other mine sites in Montana, coniferous forest debris would be removed before soil removal.

Alternative 3 - Revegetation and Success Criteria

Revegetation and success criteria would be developed for all reclaimed areas. These criteria would help assure revegetation was successful over both the short and long term, that noxious weeds did not exceed unacceptable levels, and desired cover densities were achieved and sustained in the long term.

Alternative 3 includes more stringent requirements for mine reclamation than Alternative 2 (Table 135). A 20-year revegetation monitoring period after reseeding would be required under Alternative 3 to better assure that revegetation requirements have been achieved. A longer monitoring period also would provide additional time to take corrective measures if revegetation goals had not been met.

The reclamation requirements for Alternative 3 would increase the minimum vegetation cover required after reclamation compared to Alternative 2. A total of 80 percent of total cover would be the goal compared to 70 percent for Alternative 2. Alternative 3 would require a sufficient planting of trees and shrubs to achieve 400 trees and 200 shrubs per acre living after 15 years, except in wetlands and meadows. Compared to Alternative 2, this would increase woody plant density. Woody plant densities under Alternative 3 would better match surrounding landscape features and would meet wildlife and density recommendations provided by the agencies.

All seed mixes would be revised so that mixes would be composed of species native to northwestern Montana (if commercially available) instead of a seed mix that that includes introduced species as proposed in Alternative 2. This would reduce the spread of aggressive introduced species both in reclaimed sites and nearby sites, and enhance the conditions for re-establishment of native species.

Rather than planting trees and shrubs along strips as proposed in Alternative 2, trees and shrubs would be planted by hand in random patterns to better resemble natural surroundings. Planting in random patterns along with increased woody plant densities, would return reclaimed sites to more natural conditions in less time than under Alternative 2.

Surface soil would be amended before seeding with an agencies-approved wood-based organic amendment to raise soil organic matter levels to a minimum of 1 percent by volume. This would increase water holding capacity of the soil, enhance nutrient levels, stimulate biological activity in the soil, and thereby, help ensure successful revegetation.

3.18.4.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Short- and long-term reclamation objectives would remain the same as for Alternative 2. Modifications to soil salvage and handling, vegetation removal and disposition, revegetation, success criteria, and monitoring are the same as described above in Alternative 3, with a few modifications described below.

Table 135. Mine Reclamation Requirements by Alternative.

Reclamation Requirement	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Tailings Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Tailings Impoundment Alternative
Seed Mix	Native and introduced species; interim and permanent seed mixes	Native; permanent seed mix only	Native; permanent seed mix only
Tree/Shrub Density After 15 Years	283 trees/acre (assumes a 65% survival rate of 435 trees/acre planted) Unspecified (200 shrubs/acre planted)	400 trees /acre 200 shrubs/acre	Same as Alternative 3
Noxious Weeds	No more than 10% noxious weeds	Less than 10% cover of Category 1 weeds and 0% of Category 2 and 3 weeds†; Category 1 weeds would not dominate an area greater than 400 sq ft	Less than 10% cover of Category 1 weeds and 0% of Category 2 and 3 weeds†; Category 1 weeds would not dominate an area greater than 400 sq ft
Total Cover Goal	60% live vegetation cover or 70% of control site total cover	80% of control site total cover	80% of control site total cover
Monitoring Plan	3 consecutive years of revegetation success	20 years	20 years
Total Acres of Vegetation Disturbance	2,582	2,011	2,254

†Priority weeds described in KFP; see Table 148 in section 3.21, *Vegetation*.

Alternative 4 - Soil Salvage and Handling

In Alternative 4, as under Alternative 3, where redistributed soils cover non-native material such as the entire Little Cherry Creek Tailings Impoundment Site and waste rock piles (if remaining at end of mine life), the replaced soil depth would average 24 inches using two lifts. Sufficient salvageable soil volumes are available to achieve the soil replacement goals for all potential disturbances.

The soils at the Libby Plant Site (same as Alternative 3), about 35 acres of soils in the southwestern portion of the Borrow Area outside the impoundment footprint, and about 125 acres of soil along access roads have not been mapped at an intensive, site-specific level. Before any

soils would be salvaged, MMC would conduct intensive soil surveys in these areas to ensure that the most suitable soil and necessary volumes of soil were salvaged. In addition, a two-lift soil salvage and replacement method would be conducted at the Libby Plant Site, at LAD Areas, along some portions of access roads, at other disturbances within the Little Cherry Creek Impoundment Site, and at the Little Cherry Creek Diversion Channel.

Other modifications of soil salvage and handling incorporated into Alternatives 3 and 4 have been discussed in section 2.5.3.2, *Vegetation Clearing and Soil* Salvage *and Handling Plan*. These modifications along with the modifications mentioned above would help ensure successful long-term revegetation.

3.18.4.4.5 Alternative A – No Transmission Line

In Alternative A, the transmission line and substation for the Montanore Project would not be built. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

3.18.4.4.6 Alternative B – MMC Proposed North Miller Creek Alternative

Alternative B - Soil Salvage and Handling

Soils would be salvaged and replaced using a single-lift method and would be handled in the same manner as explained in Alternative 2. Not using the double-lift salvage and replacement method would mix relatively organic-rich and nutrient-rich surface soil with poorer quality subsoil and place more unproductive soil on the surface, which could delay successful reclamation. Where soils are salvaged from new access roads, the soil would be stored adjacent to the disturbance.

Roads opened or constructed for transmission line access would be closed after the transmission line had been built. The road surfaces would be reseeded as an interim reclamation activity designed to stabilize the surface. Where soil had been salvaged from new roads, the road surface would be covered with soil and then reseeded. The new road prism would remain until the transmission line was removed at the end of operations. After the transmission line was removed, all newly constructed roads would be recontoured to match the existing topography, obliterating the road prism.

Alternative B - Vegetation Removal and Disposition

MMC has not proposed any special plan to deal with vegetation removal and disposition other than harvesting trees and burning slash. This could result in the loss of a source of native plant materials, less organic debris for BMPs such as slash filter windrows or use of chipped non-coniferous wood debris, and loss of potential organic enrichment in stockpiled soils. Opportunities to enhance reclamation success could be lost.

Alternative B - Revegetation and Success Criteria

At the end of the mine life and following redistribution of soil, all access roads would be reseeded with the same seed mixes as in Alternative 2. MMC has not proposed to plant trees on reclaimed access roads and other disturbances where trees were removed such as line stringing and

tensioning sites, slash burn piles, and construction pads. MMC's revegetation plan for the transmission line access roads would have the same long-term effects as under Alternative 2, including the spread of introduced plant species, the additional years required for trees and shrubs to become established on reclaimed road surfaces and other disturbance sites, and the potential for spreading noxious weeds. The revegetation, success criteria, and monitoring would be the same as under Alternative 2.

3.18.4.4.7 Alternative C – Modified North Miller Creek Alternative

Alternative C - Soil Salvage and Handling

Under the Modified North Miller Creek Alternative, soil salvage and handling would be the same as under Alternative B for road construction and for interim reclamation. The effects to soils also would be the same.

For final decommissioning of access roads, the surface soil that had been in place on access roads for the life of the transmission line would be salvaged, the road prism obliterated, and then the surface soil replaced. The surface soil that had been in place for the life of the transmission line would have higher nutrient levels, higher organic matter content, and greater microbial activity than the underlying soil, and it would be a seed source for the native plants that had established over the life of the transmission line. This would shorten the amount of time for vegetation to re-establish. The depth of surface soil salvage would be determined by the lead agencies prior to final reclamation. Other soil handling methods would be in the same manner as under Alternative B.

At the end of operations, mycorrhizae and an agencies-approved wood-based mulch would be incorporated into the upper 4 inches of soil to raise the soil organic matter levels to 1 percent by volume in the recontoured road surfaces. This would shorten the amount of time to successfully reclaim all transmission line access roads.

In Alternatives C, D, and E, wooden structures would be used (steel monopoles would be used a 1-mile segment of Alternative E). Wooden poles would be treated to reduce decay; a typical preservative contains sodium, copper and petroleum compounds. Typically, soil contamination surrounding a pole is non-existent or very minor.

Alternative C - Vegetation Removal and Disposition

As described in section 2.5.3.2.1, *Vegetation Removal and Disposition*, a Vegetation Removal and Disposition Plan would be prepared that evaluates the potential uses of vegetation removed from areas to be disturbed. This plan would result in the maximum use of native plant materials and organic debris for BMPs to enhance reclamation success.

Alternative C - Revegetation and Success Criteria

Trees would be planted in all areas where trees were removed for the construction of the transmission line including access roads and other disturbances such as line stringing and tensioning sites, slash burn piles, and construction pads. Trees would be planted at a density that at the end of 5 years the approximate stand density of the adjacent forest would be attained at maturity. This standard would not apply to roads placed in intermittent stored status, but would apply when the roads would be decommissioned after the transmission line was restored. Planting trees in disturbances would require less time for trees to become establish, would better match

surrounding landscape features, and would meet wildlife and density recommendations provided by the agencies.

All seed mixes for both interim reclamation and final reclamation would be revised so that mixes would be composed of species native to northwestern Montana and not contain introduced species. This would reduce the spread of aggressive introduced species both in reclaimed sites and nearby sites, and enhance the conditions for re-establishment of native species. The monitoring plan, revegetation, and success criteria (except tree and shrub densities) would be the same as under Alternative 3.

3.18.4.4.8 Alternative D – Miller Creek Alternative

For the Miller Creek Alternative, effects and modifications to soil salvage and handling, vegetation removal and disposition, revegetation, and success criteria would be the same as for Alternative C.

3.18.4.4.9 Alternative E – West Fisher Creek Alternative

For the West Fisher Creek Alternative effects and modifications to soil salvage and handling, vegetation removal and disposition, revegetation, and success criteria would be the same as for Alternative C.

3.18.4.5 Cumulative Effects

Past actions, particularly road construction, timber harvest, and mining activities have increased erosion rates in comparison to undisturbed areas in the analysis area. As vegetation in timber harvest areas return to pre-harvest conditions, erosion rates have and would continue to decrease. Cumulative effects to soils from other current and foreseeable actions would be associated primarily with potential soil loss from erosion and loss of soil productivity. Other regional current and foreseeable actions that would affect soil resources include timber harvest, mineral exploration, and new road construction. These actions would potentially occur on both public and private lands. There may also be abandoned mine waste cleanup on public and private lands, and continued commercial and residential development on private lands. The primary soil disturbance of many of these activities would be from road construction, and also from soil removal due to mine reclamation, home construction, paving of access roads and driveways, etc. These actions would result in an increase in erosion and sedimentation within the Libby Creek and Fisher River watersheds, and a loss of soil productivity in areas where soil was removed, stored for prolonged periods, and then replaced.

KNF requires the implementation of BMPs for logging, mine reclamation, and road-building operations. Private landowners are not required to use BMPs. If BMPs were properly implemented and maintained, onsite erosion and potential increases in sedimentation to creeks would be minimized, and soil erosion losses would be a minor cumulative impact. The loss of soil productivity associated with most of the current and foreseeable actions would be a minor impact. Permanent effects would occur where lands become unproductive due to paved or graveled road surfaces.

3.18.4.6 Regulatory/Forest Plan Consistency

Proposed lands allocated for the action alternatives would be reallocated to non-timber production land, consequently, the only standards in the KFP that would apply to these lands would be the implementation of BMPs to control erosion and sedimentation. Therefore, all action alternatives

would be in compliance with soil standards and guidelines outlined in the KFP, and all alternatives are expected to meet the forest plan standard for the protection of soils with their required mitigations implemented.

3.18.4.7 Irreversible and Irretrievable Commitments

Some soil would be irreversibly lost under all action alternatives during soil removal, construction, and operation of the mine prior to the re-establishment of vegetation. Some soil would be irreversibly lost under transmission line Alternatives B through E, especially during construction and final reclamation of access roads. Soil productivity would be irreversibly lost in large areas under Alternative 2, along portions of access roads under Alternatives 3 and 4, and along transmission line access roads under all alternatives where single-lift salvage and replacement was used, because the soil profile would be altered and would require many years for soil productivity to return to pre-mine conditions. The time required to restore soil productivity would be shortened with the use of soil amendments. A minor amount of soil productivity would be irreversibly lost under all action alternatives along NFS road #278 due to widening of the road.

Irretrievable effects to soil productivity would result from prolonged soil stockpiling and at disturbances that would not be reclaimed until the end of mine life, such as at plant sites and most of Little Cherry Creek and Poorman Tailings Impoundment sites. Irretrievable effects to soil productivity would result along transmission line access roads where road prisms would remain until final reclamation of the transmission line. These irretrievable effects would be minimized with the use of fertilizers and mulches. Irretrievable effects to soil productivity would be limited at areas under Alternatives 3 and 4 where double-lift soil salvage and replacement was used. The replaced lift soils under Alternatives 3 and 4 also would have wood-based mulch and mycorrhizae incorporated into the upper 4 inches of soil. These measures would accelerate the rebuilding processes for respread soils to reach pre-mine productivity levels. Irretrievable effects to soil productivity would be limited on access roads of transmission line under Alternatives C through E with removal and replacement of the surface soil for final reclamation, and with the addition of wood-based mulch and mycorrhizae into the upper 4 inches of soil during final reclamation.

3.18.4.8 Short-term Uses and Long-term Productivity

Soil losses due to erosion would be long-term, but would return to natural rates once vegetation was re-established and stabilized reclaimed areas, in about 3 to 5 years following reclamation. Over steepened and south- and west-facing cut slopes may require more than 5 years for the vegetation ground cover to reach predisturbance levels without soil amendments. Decreases in soil productivity would be long-term in all reclaimed areas. The degree of soil productivity losses would vary among the action alternatives and would be more severe under Alternative 2 and under transmission line Alternatives B through E in areas where single-lift soil salvage and replacement would be used. These areas primarily include the Ramsey Plant Site, the Little Cherry Creek Diversion Ditch, mine roads, the Libby Adit Site, and all transmission line access roads. Due to mixing of soil horizons and prolonged storage, soil profile characteristics would be drastically changed over pre-mine conditions. Soil productivity would decrease under Alternative 2 on the top of the Little Cherry Creek Tailings Impoundment if 18 inches of soil were placed over crusted fine-grained tailings, which would restrict rooting depth.

3.18.4.9 Unavoidable Adverse Environmental Effects

Loss of soil development since the last major climate change in the area would result in all action alternatives. Soil erosion to some degree would occur under all action alternatives, even with implementation of proposed mitigation measures. The degree of effects of soil erosion would be more severe under Alternative 2 and less under Alternatives 3 and 4 because of the additional erosion control methods and the fewer acres of soil disturbance under Alternatives 3 and 4. Loss of soil productivity would be unavoidable under all action alternatives in all disturbances where soil was removed, stored, and replaced. The degree of effects to soil productivity would be more severe under Alternative 2 and under transmission line Alternatives B through E where single-lift soil salvage and replacement was used.

3.19 Sound, Electrical and Magnetic Fields, Radio and TV Effects

3.19.1 Regulatory Framework

3.19.1.1 Sound

Noise is generally defined as unwanted sound, and can be intermittent or continuous, stationary or transient. Noise levels heard by humans and animals depend on several variables, including distance and ground cover between the source and receiver and atmospheric conditions. Noise can influence humans or wildlife by interfering with normal activities or diminishing the quality of the environment. Noise levels are quantified using units of decibels (dB). The dBA scale begins at zero—the sound intensity at which sound becomes audible to a young person with normal hearing. Each 10 dBA increase in sound approximates a doubling in loudness, so that 60 dBA is twice as loud as 50 dBA. People generally have difficulty detecting sound level differences of 3 dBA or less.

No federal, KNF, or county regulations govern noise levels in the analysis area (Big Sky Acoustics 2006). The EPA identifies outdoor noise levels less than or equal to 55 dBA are sufficient to protect public health and welfare in residential areas and other places where quiet is a basis for use. The Montana Department of Transportation (MDT) determines that traffic noise impacts occur if predicted 1-hour traffic noise levels are 66 dBA or greater at a residential property during the peak traffic hour (Big Sky Acoustics 2006). Noise associated with the transmission line is required to be 50 dBA or less at the edge of the right-of-way in residential and subdivided areas unless the affected landowner waives this condition (ARM 17.20.1607.2 (a)).

3.19.1.2 Electrical and Magnetic Fields

"EMF" is an abbreviation for the electric field and magnetic field associated with electric power systems. In the United States, these systems and their associated transmission lines operate at a frequency of 60 hertz (Hz), and therefore create 60-Hz EMFs. EMFs occur in the environment naturally and as a result of human activity. Naturally occurring EMFs are created by the weather and the geomagnetic field. The electric power transmission and distribution system is the principal source of environmental 60-Hz EMFs. EMFs are weak except near power lines, substations, electrical machinery, and appliances.

Electric fields from power lines are created when a voltage is placed on the conductors, a step known as energizing the line. Electric fields exist in the space surrounding an energized object and have a strength measured by the unit "volt per meter" (V/m) or 1,000 volts per meter (kV/m). Electric field strength is determined by the voltage on the line and does not change with power flow. Electric field strength attenuates rapidly with increasing distance from the power line and can be reduced by trees with foliage and houses and greatly reduced by metal and other conducting surfaces.

Magnetic fields from power lines are created whenever current flows through power lines. The strength of the field is directly dependent on the current in amperes in the line but not the voltage. Magnetic field strength near electric power lines is typically measured in milligauss (mG). Similar to electric field strength, magnetic field strength attenuates rapidly with distance from the source, but unlike electric fields, magnetic fields are not easily shielded by ordinary objects and

materials. Both electrical and magnetic fields are low energy, extremely low frequency fields, and should not be confused with high energy or ionizing radiation such as X-rays and gamma rays.

No federal, KNF or county regulations govern electrical and magnetic fields in the analysis area. Montana major facility siting regulations require that the electric field strength at the edge of the right-of-way be no greater than 1 kV/m in residential and subdivided areas unless the affected landowner waives this condition and that the electric field at road crossings be no greater than 7 kV/m (ARM 17.20.1607.2(d)). Montana has no regulation concerning 60-Hz magnetic fields of power lines.

3.19.1.3 Radio and TV Effects

Radio and television interference are collectively referred to as radio noise. Radio noise is a phenomenon produced by both corona and sparking and can vary greatly based on weather conditions. Television interference is significant only for foul weather conditions. Corona occurs when the electrical field at a particular point reaches a sufficiently high value to cause ionization of the surrounding air. Corona on transmission lines can cause power loss, radio, and television interference and audible noise near the transmission line.

No KNF, state or county regulations govern radio or television interference in the analysis area. The Federal Communications Commission (FCC) regulations pertaining to the prevention of radio and television interference vary by service. Such regulations are usually included in the operating requirements section for each service.

For transmission lines with normal conductor spacings and rights-of-way, a fair-weather radio interference level of about 40 decibel-microvolts per meter (dBμV/m) at a lateral distance of 100 feet from the outermost phase has been established as a guideline for identifying design criteria for a radio noise limit (IEEE Standard 430-1991).

3.19.2 Analysis Area and Methods

The analysis area encompasses an area potentially affected by project facilities: along the Bear Creek Road south from U.S. 2; the area surrounding the proposed mine facilities; and the area crossed by the four transmission line alternatives and associated access roads.

3.19.2.1 Sound

Woodward-Clyde Consultants collected ambient noise levels measurements at the Ramsey Plant Site and the Little Cherry Creek Tailings Impoundment Site in 1988 (Woodward-Clyde Consultants 1989c). Ambient noise levels in the analysis area are unlikely to have changed significantly since 1988. Big Sky Acoustics completed two, 5-minute noise level measurements in 2005 above the Troy Mine mill and portal (Big Sky Acoustics 2006). The Troy Mine is located about 20 miles northeast of the proposed Montanore Project and uses similar underground mining and milling techniques. Big Sky Acoustics developed predicted noise level contours that would develop under various operating conditions using noise prediction software.

3.19.2.2 Electrical and Magnetic Fields and Radio and TV Effects

Power Engineers calculated electrical and magnetic fields and radio and television interference for MMC's proposed structure configuration (Power Engineers 2005a). A steel monopole structure 90 feet in height was used in the analysis. BPA's corona and field effects program was

used in the calculations. A similar calculation using BPA's corona and field effects program was made for the H-frame structures that would be used in the other three transmission line alternatives (HDR Engineering 2007). The lead agencies completed an evaluation of the potential for environmental impacts from transmission line EMFs (Asher Sheppard Consulting 2007). The evaluation addresses the current status of scientific knowledge concerning potential health effects from exposure to transmission line EMFs.

3.19.3 Affected Environment

3.19.3.1 Sound

Except for the Libby Adit Site, existing sound levels in the analysis area are low, characteristic of rural areas and wilderness (Table 136). Nighttime sound levels are 4 to 12 dB lower than daytime levels due to cessation of many human-related activities. Wind conditions during the monitoring period were low, less than 15 mph, eliminating wind as a significant sound source. Natural sound sources include wind, wildlife, water flow, thunder, and wind-induced noise such as the rustling of foliage. Other sound sources include vehicles, such as trucks or airplanes, and man. The overall contribution from human activities is small, and the predominant sound sources are natural. Wildernesses typically have very low noise levels. The Rock Creek Final EIS reported daytime noise levels at the CMW boundary of 25 to 27 dBA (USDA Forest Service and DEQ 2001).

Large-lot residential properties, ranches, and cabins are found along U.S. 2 near Libby Creek Road (NFS road #231), Bear Creek Road (NFS road #278), the Fisher River, Pleasant Valley, and Schrieber Lake. Fifteen residences or cabins are within 1 mile of the four transmission line alternatives. Most of these properties are within 0.5 mile of U.S. 2.

Table 136. Summary of Ambient Sound Measurements.

Measurement Period	Little Cherry Creek Impoundment Site	Ramsey Plant Site
Midweek		
Day (L_d)	39.0	41.3
Night (L_n)	35.5	28.8
Average 24-hour (L_{dn})	42.6	40.5
Weekend		
Day(L_d)	28.6	40.1
Night (L_n)	22.7	31.3
Average 24-hour (L_{dn})	30.6	40.6

Source: Woodward-Clyde Consultants, Inc. 1989a.

3.19.4 Environmental Consequences

3.19.4.1 Sound

3.19.4.1.1 Alternative 1 – No Mine

The analysis area would continue to have quiet sound levels characteristic of rural areas and wilderness lands. Existing noise levels would not change. Activities on private land at the Libby

Adit Site would remain until reclaimed in accordance with existing permits and approvals. These activities would increase ambient noise levels near the adit.

3.19.4.1.2 Alternative 2 – MMC's Proposed Mine

Construction Phase

During the construction phase, noise would be produced by heavy equipment, such as scrapers, bulldozers, graders, loaders, and rock trucks. The noise produced by diesel-powered equipment typically is 85 dBA at a distance of 50 feet from the equipment. Equipment noise can vary considerably depending on age, condition, manufacturer, use during a time period, and a changing distance from the equipment to a listener location. To minimize equipment noise, MMC would supplement backup beepers on surface equipment with strobe light-type warning devices and the sound level of the backup beepers would be reduced to the minimum level necessary to comply with safety regulations.

Generators would be used to supply power as the adits were developed, and each generator is predicted to produce a noise level of about 82 dBA at 50 feet. Ventilation fans would be located outside of the portals, and include inlet and discharge attenuators to meet a total noise level of 85 dBA at 3 feet (Big Sky Acoustics 2006). Noise from the generators and fans would extend into the CMW, reaching about 30 dBA along the ridge between Elephant Peak and Eagle Peak (Big Sky Acoustics 2006). These sound levels in the CMW would be slightly above existing levels, affecting recreational users of this portion of the CMW. Noise from generators would cease after 2 to 3 years when the transmission line was completed.

Highest noise levels would be generated periodically at the Ramsey Plant Site as a result of blasting. Blasting noise near the surface during the preproduction phase is predicted to be equal to 122 dBA at 0.6 mile from the Ramsey Plant Site, and equal to the existing ambient noise level at up to about 8 miles from the site. Blasting noise would be greatest during initial adit construction; as the adits go deeper, blasting noise would decrease. The Rock Lake Ventilation Adit would be constructed from the mine to the surface. Very short-term blasting would be necessary when the adit daylighted on private land east of and above Rock Lake.

Construction phase activities also would include: hauling of waste rock to the Little Cherry Creek Impoundment Site; excavation of borrow material from the Little Cherry Creek Impoundment Site; and construction of a Starter Dam, Diversion Channel and Seepage Collection Dam at the Little Cherry Creek Impoundment Site. Noise levels between 30 and 40 dBA would be experienced in areas within 2.5 miles of the source, depending on the topography and atmospheric conditions. Some blasting may be necessary in the upper part of the diversion channel. Elevated noise levels from blasting would be short and intermittent.

Construction truck traffic over a 1-year period to and from the Plant Site, Tailings Impoundment Site, and Libby Loadout would increase noise levels on the Libby Creek Road (NFS road #231) while the Bear Creek Road is reconstructed. Trucks with properly operating mufflers would be expected to generate up to an estimated 86 dBA at 50 feet. Trucks using Jake brakes with straight pipe mufflers would produce sound levels of 98 dB(A) at 50 feet, and would be audible at distances of up to 1 mile. Similar noise levels would occur along the Bear Creek Road (NFS road #278) during the construction period. The noise effects would be similar to those of trucks transporting logs from a timber sale. These haul trucks would affect residences adjacent to the access road.

Operations Phase

Noise at the Ramsey Plant Site would be slightly less during operations than during the construction phase. Ore would be processed inside the mill buildings. Noise from enclosed milling operations is typically audible as a low level hum, and was measured as 49 dBA at about 328 feet near the Troy Mine plant (Big Sky Acoustics 2006). Noise levels greater than the EPA guideline of 55 dBA would occur in the immediate vicinity of the Ramsey Plant Site, but would decrease substantially with distance from the mill. For example, noise levels at the Troy Mine were 49 dBA 330 feet from the mill. Noise levels between 30 and 55 dBA would extend into the CMW to Elephant Peak and down the Ramsey Creek drainage to about the LAD Area 1 (Big Sky Acoustics 2006). At all project facilities, backup beepers on surface equipment would be supplemented with strobe light-type warning devices. The sound level of the backup beepers would be reduced to the minimum level necessary to comply with safety regulations. These sound levels in the CMW would be slightly above existing levels, affecting recreational users of this portion of the CMW.

The fan associated with the Rock Lake Ventilation Adit would be located inside the mine, and not at the portal. The walls of the raise and adit would reduce the noise from the fan at the surface. Noise level at the portal of the Rock Lake Ventilation Adit is estimated to be 16 dBA and would not be audible over ambient noise levels (Big Sky Acoustics 2006).

Noise at the Little Cherry Creek Impoundment Site and LAD Areas would be generated by heavy equipment during construction and by occasional vehicular traffic, pumps and associated equipment, and bulldozers during operations. The sound from bulldozers would be periodic. In general, the production phase noise levels are predicted to be equal to 55 dBA within about 0.2 mile of the facility, and would be equal to the lowest measured existing ambient noise level of 30 dBA within about 2.5 miles of the sites (Big Sky Acoustics 2006).

Truck and train traffic and heavy equipment would increase noise at the Libby Loadout. Loadout activities would generate sound levels similar to other operations. The increased noise levels would be less noticeable because of higher ambient noise levels.

Closure Phase

After operations cease, MMC would remove all facilities from the plant and adit sites. Reclamation at the Ramsey Plant Site, the Libby Adit Site, and the Rock Lake Ventilation Adit Site would take several years. Noise at these locations would be generated by heavy equipment during reclamation and by occasional vehicular traffic. Heavy equipment also would be used at the tailings impoundment. The decommissioning and closure period is expected to require a minimum of 10 years, and possibly up to 25 years of monitoring (Klohn Crippen Consultants 2005). Reclamation activities would generate sound levels similar to the operations phase. At the end of reclamation, noise levels at all project facilities would return to pre-mine levels. Traffic and activities associated with any long-term monitoring or water treatment would generate slightly increased noise levels.

3.19.4.1.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Noise sources and general magnitude of effects during all phases of operations in Alternative 3 would be similar to Alternative 2. Ventilation adits would be in Libby Creek and near Rock Lake. During construction of the adits, elevated noise levels would extend up and down the Libby Creek drainage in a similar manner as in Ramsey Creek in Alternative 2. Noise from the generators and fans would extend into the CMW, reaching about 30 dBA along the ridge between

Elephant Peak and Ojibway Peak. Noise from generators would cease after 2 to 3 years when the transmission line was completed.

Construction of the Libby Plant Site would increase noise levels in the lower Ramsey Creek drainage and in the Libby Creek drainage east of the Libby Adit. Recreational users at the Libby Gold Panning Recreation Area would experience noise levels between 45 and 55 dBA.

3.19.4.1.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Noise sources and general magnitude of effects during all phases of operations at the Libby Plant Site, Upper Libby Adit Site and LAD Areas 1 and 2 in Alternative 4 would be the same as in Alternative 3. Noise effects at the Little Cherry Creek Impoundment Site would be the same as Alternative 2.

3.19.4.1.5 Alternative A – No Transmission Line

In Alternative A, the transmission line and substation for the Montanore Project would not be built. Noise levels associated with the existing 345-kV BPA transmission line would not change. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

3.19.4.1.6 Alternative B – MMC's Proposed Transmission Line

Noise During Transmission Line Construction, Operations, and Decommissioning

Transmission line construction would temporarily increase daytime ambient noise levels along the transmission line corridor. During the estimated 6-month transmission line construction period, construction equipment such as bulldozers, loaders, and haul trucks would generate 100 to 120 dB(A) at 50 feet. Chain saws and logging trucks used in forest clearing for the line would generate similar noise levels. These sounds would generally occur in hilly, forested areas, which would serve to reduce sound audibility. A helicopter may be used for four activities, depending on the construction contractor, structure placement, line stringing, timber harvest, and annual inspection and maintenance. Helicopters may be used for logging steep terrain. Logging may take one to two months, depending on the area logged. Structure placement and line stringing would take a week or two each. Annual inspections may take about a week. Increased noise levels would be audible residences along U.S. 2, residences along West Fisher Creek and Standard Creek (Figure 78) and recreational users at the Libby Creek Recreation Gold Panning Area and on trails along the alignment of this alternative. Similar helicopter noise would be audible during annual inspections of the line. When the line and structures were removed at mine closure, noise from helicopters, vehicles and other heavy equipment would be audible residences along U.S. 2 and recreational users at the Libby Creek Recreation Gold Panning Area and on trails along the alignment. Some residents may perceive air pressure changes as vibrations from the helicopter use.

Because of generally low ambient background noise levels, the transmission line clearing, road construction, and line construction activities would be generally audible for about 2.5 miles, depending on the topography and atmospheric conditions. This could include the campground at Howard Lake and homes and recreational use areas along the Fisher River Valley. Equipment trucks or logging trucks could extend the audible area. All off-site truck traffic would temporarily

increase noise levels at residences adjacent to travel routes to and from the construction area. The effects would be similar to logging trucks transporting logs from an active timber sale area. The increased noise levels would be short-term, and would return to ambient levels when the noise-generating activity was completed.

Transmission Line Noise

The proposed 230-kV electrical power transmission line would produce soft hissing and crackling sounds in wet weather. In fair weather, these noises are virtually inaudible. During the light rains or wet snows which occur about 10 percent of the time in the analysis area, the transmission line would produce a noise level of about 50 dB(A) at the edge of the right-of-way (Power Engineers 2005a). The closest residence to MMC's proposed centerline would be about 380 feet; two other residences along U.S. would be between 400 and 500 feet from the centerline. The proposed centerline may vary up to 250 feet from the final centerline in final design. Expected noise levels at a residence about 380 feet from the centerline during a light rain or wet snows would be between 40 and 45 dBA (Power Engineers 2005a). This sound level would be slightly above naturally occurring levels and would be faintly discernible. The sound level would be less than 20 dBA during fair weather, and would not be audible over existing sounds. Because BPA's Sedlak Park Substation would not contain a transformer, there would be no audible hum emanating from the substation. Whenever breakers were to open and close, an audible noise would be heard by those in close proximity to the substation. The noise would be infrequent, occurring no more than a few times per year, and would be no louder than the noise from a shotgun blast.

3.19.4.1.7 Alternatives C, D, and E – Other Transmission Line Alternatives

Noise Transmission Line Construction, Operations, and Decommissioning Noise

Noise sources and general magnitude of effects during all phases of construction operations, and decommissioning in Alternatives C, D and E would be similar to Alternative B. Noise associated with BPA's Sedlak Park Substation also would be the same as Alternative B.

Selected structures would be constructed and timber harvested with helicopter. Depending on the alternative, noise levels in the upper part of the Miller Creek tributary (Alternative C), Miller Creek (Alternative D) and along West Fisher Creek and Standard Creek (Alternative E) would experience noise from helicopters, heavy equipment, and chain saws between the work location and staging area during construction. Similar noise levels would be audible during annual inspections, and final line decommissioning. Helicopters would be used for five activities: logging, structure placement, line stringing, and annual inspection and maintenance, and decommissioning. Logging may take one to two months and structure placement and line stringing would take a week or two each. Annual inspections may take about a week. Increased noise levels would be audible at private residences along U.S. 2 where the alignment crosses the Fisher River, and at a private residence along West Fisher Creek in Alternative E. In Alternatives C, D and E, recreational users at the Libby Creek Recreation Gold Panning Area and on trails along the alignment would experience higher noise levels during construction, annual inspections, and decommissioning. The increased noise levels would be short-term, and would return to ambient levels when the noise-generating activity is completed.

The alignment in the Miller Creek and West Fisher Creek Alternatives would follow NFS road #231 east of Howard Lake. At the closest location, the alignment in these two alternatives would be about 1,300 feet east of the Howard Lake Campground and about 1,000 feet east of the eastern shore of Howard Lake. Recreational users at the campground and Howard Lake would experience

higher noise levels during construction, annual inspections, and decommissioning. The increased noise levels would be short-term, and would return to ambient levels when the noise-generating activity is completed.

Transmission Line Noise

No residences are within 500 feet of the centerline of the Modified North Miller Creek or Miller Creek Alternatives. Two residences are within 500 feet of the West Fisher Creek Alternative; both would be between 350 and 400 feet from the centerline. Expected noise levels at a residence 350 to 500 feet from the centerline during a light rain would be between 35 and 40 dBA (HDR Engineers 2007) and probably would not be noticeable over existing noise levels.

3.19.4.2 Electrical and Magnetic Fields

3.19.4.2.1 Alternative A – No Transmission Line

In Alternative A, the transmission line and substation for the Montanore Project would not be built. Existing electrical and magnetic fields associated with the existing 230-kV BPA transmission line would not change. If existing residences are typical of others in the United States, average residential electric fields would be less than 10 V/m and magnetic fields of the order of 1 mG or less. EMFs of these levels are not known to have the potential for an adverse effect on health. Under this alternative, the residences would have no recognized potential of an EMF health impact.

3.19.4.2.2 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Within 0.5 mile of this alignment, 14 residences are present, of which 11 are greater than 450 feet from the centerline of the ROW and the remaining three are within 450 feet. Because the final alignment could vary by up to 250 feet of the centerline analyzed in this EIS (ARM 17.20.301 (21)), three residences may be within 200 feet of the centerline depending on final transmission line alignment. At lateral distances from the edge of the ROW (50 feet from the centerline) to 200 feet away, the electric field strength would range from about 0.75 kV/m at 50 feet to about 0.05 kV/m (or 50 V/m) at 200 feet. The magnetic field strength would be about 4 mG at 50 feet and less than 1 mG at 200 feet. This maximum electric strength at 50 feet would be below the level set by Montana regulation for electric field strength and both the electric and magnetic field strengths at 50 feet would be below the exposure levels for the general public recommended as reference levels or maximum permissible levels (Asher Sheppard Consulting 2007).

3.19.4.2.3 Alternatives C, D, and E – Other Transmission Line Alternatives

The seven residences along the Modified North Miller Creek Alternative and the eight residences along the Miller Creek Alternative within 0.5 mile are greater than 450 feet from the centerline. The electric field strength would be less than about 0.05 kV/m (or 50 V/m) and the magnetic field strength would be less than 1.0 mG. Based on the electric and magnetic field strengths recommended in guidelines as reference levels or maximum permissible levels for the general public, and the current state of scientific research on EMFs, these alternatives are categorized as having no recognized potential for a health impact from exposure to EMFs (Asher Sheppard Consulting 2007).

Seven residences are within 0.5 mile of the West Fisher Creek centerline, of which five are more than 450 feet from the centerline and the remaining two are within 450 feet of the centerline. As part of this alternative, the centerline would be not closer than 200 feet from any residence during

final design. For residences 200 feet or more from the centerline, the electric field strength would be about 0.05 kV/m (or 50 V/m) and the magnetic filed strength would be less than 1 mG. Based on the electric and magnetic field strengths recommended in guidelines as reference levels or maximum permissible levels for the general public, and the current state of scientific research on EMFs, the alternative is categorized as having no recognized potential for a health impact from exposure to EMFs (Asher Sheppard Consulting 2007).

3.19.4.3 Radio and TV Effects

3.19.4.3.1 Alternative A – No Transmission Line

In Alternative A, the transmission line and substation for the Montanore Project would not be built. Radio and TV interference associated with the existing 230-kV BPA transmission line would not change.

3.19.4.3.2 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

The transmission line would generate radio noise that may interfere with AM radio and television reception close to the line. FM broadcasts and 2-way communications generally would not be affected. The effect of the line on AM radio and TV interference would decrease rapidly as distance from the line increases. The closest residence to the North Miller Creek Alternative is 380 feet from the proposed centerline, west of U.S. 2 (Asher Sheppard Consulting 2007). Under Montana's regulations, the proposed centerline may vary up to 250 feet from the final centerline in final design. The calculated radio interference at the closest residence of MMC's proposed centerline (380 feet) would be between 40 and 45 dBμV/m for the rain-weather condition and around 25 dBμV/m for the fair-weather condition. The calculated television interference at the closest residence (380 feet) would be about 8 dBμV/m for the rain-weather condition. A guideline for radio noise is a fair-weather level of about 40 dBμV/m at a lateral distance of 100 feet from the outermost phase (Power Engineers, Inc. 2006a).

If interference were to occur once the line was energized, MMC or the operating utility would correct the interference as required by FCC regulations and the Environmental Specifications (Appendix D). Correction of interference would depend on site-specific circumstances. According to FCC regulations, the line must not degrade radio or TV reception beyond current levels. Typically, changes in line operation or measures such as installation of remote antennae correct most interference problems (Power Engineers, Inc. 2006a). Possible radio and TV interference problems along the transmission line typically cannot be accurately identified until the final line location and design are known.

3.19.4.3.3 Alternatives C, D, and E – Other Transmission Line Alternatives

The three other transmission line alternatives would use the eastern alignment and route the line east of the homes along U.S. 2. The Modified North Miller Creek alignment has no residences within 500 feet of the centerline; therefore, effects on radio and TV would not occur. The Miller Creek Alternative has one residence and the West Fisher Creek Alternative has two residences between 350 and 500 feet of the centerline. The effects on radio and television interference of the other transmission line alternatives would be similar to the North Miller Creek Alternative.

3.19.4.4 Cumulative Effects

Past actions and current actions, such as the activity at the Libby Adit Site, and vehicular traffic and NFS roads, have increased ambient noise levels over that of an undisturbed forest. The existing BPA transmission line also has EMF near the line. The KNF's Miller-West Fisher Vegetation Management Project will consist of vegetative treatments including timber harvest, slash treatment, site preparation, prescribed burning, tree planting, precommercial thinning, construction of new roads, road storage and decommissioning activities, road reconstruction, and implementation of best management practices. Depending on the timing of these activities and construction of the transmission line, noise from equipment and helicopters may be cumulatively greater in the Miller Creek and West Fisher Creek drainages. Many of the reasonably foreseeable actions would use the same roads as the Montanore Project. The reasonably foreseeable actions and the Montanore Project would cumulatively increase traffic noise near access roads. Cumulative noise levels would unlikely to exceed 55 dBA.

3.19.4.5 Regulatory/Forest Plan Consistency

The applicable Montana administrative rules require that the electric field strength at the edge of the ROW be no greater than 1 kV/m in residential and subdivided areas and at road crossings be no greater than 7 kV/m. Calculations performed under assumptions of line operating conditions that would produce maximum strength electric and magnetic fields do not exceed these restrictions (Power Engineers 2005a, HDR Engineers 2007). Montana has no rule or regulation concerning 60-Hz magnetic fields of power lines. Montana also requires that transmission lines be constructed in conformity with the National Electric Safety Code. All proposed transmission line alternatives would meet this requirement. In addition, MMC would be required to prevent unacceptable interference with stationary radio, television, and other communication systems as a condition of the certificate. In summary, all transmission line alternatives would comply with Montana rules concerning EMF levels and transmission line safety.

3.19.4.6 Irreversible and Irretrievable Commitments

The quiet sound levels characteristic of the analysis area would be irretrievably lost during the construction, operations, and closure phases.

3.19.4.7 Short-term Uses and Long-term Productivity

Elevated noise and EMF levels in all action alternatives would cease at mine closure and transmission line decommissioning, and would be a short-term use of the existing environment.

3.19.4.8 Unavoidable Adverse Environmental Effects

Elevated noise levels in upper Libby Creek would occur during the reclamation of the Libby Adit in the No Action Alternative. Similar noise levels would occur during construction, operations, and reclamation would occur between Libby Creek and the Cabinet Mountains in all mine action alternatives. Elevated noise from equipment and helicopter use in drainages in which the transmission line would be built would occur in all transmission line action alternatives.

3.20 Transportation

The transportation resource consists of a network of roadways that would be used during activities related to the proposed mine and transmission line. This section discusses the effects on roadway level of service and safety. Effects on public access in the analysis area have been discussed in section 3.15, *Recreation*.

3.20.1 Regulatory Framework

The roads analysis complies with regulations governing the administration of the Forest Transportation System (36 CFR 212) and with the Forest Service Transportation Administrative Policy FSM Chapter 7700 (2001). The Forest Service regulations intended to help ensure that additions to the National Forest System road network are those deemed essential for resource management and use; that construction, reconstruction, and maintenance of roads minimize adverse environmental impacts; and that unneeded roads are decommissioned and restoration of ecological processes are initiated. Current Forest Service roads policy requires a science-based transportation analysis (USDA Forest Service 1999a).

Kootenai Forest Plan
Goals, objectives, and standards that apply to Forest System Roads (roads wholly or partly within or adjacent to and serving the National Forest System and which are necessary for the protection, administration and utilization of the National Forest System and the use and development of its resources) are discussed below. Applicable general Forest-wide goals and objectives address road densities, soil erosion, and water quality concerns. Applicable KFP standards governing roads are that development activities will be rigorously examined to insure that the minimum number and length of roads are constructed to the minimum standard necessary. The KFP, which incorporates INFS standards, establishes stream, wetland, and landslide-prone area protection zones called RHCAs, and set standards and guidelines for managing activities that potentially affect conditions within the RHCAs. INFS standards applicable to roads have been discussed in section 3.6, *Aquatic Life and Fisheries*.

3.20.2 Analysis Area and Methods

3.20.2.1 Analysis Area

In Alternative 2, MMC would use U.S. 2, NFS road #278 (Bear Creek Road), 1.7 miles of new access road, and NFS road #4781 (Ramsey Creek Road) to access the plant site and tailings impoundment. About 10 miles of the Bear Creek Road (NFS road #278), from U.S. 2 to the Bear Creek bridge, would be paved with chip-seal and upgraded to 20 to 29 feet wide. U.S. 2 would be used from Libby, Montana (U.S. 2 milepost (MP) 32.7) to the intersection with Bear Creek Road (MP 39.7). Approval of the approach road to the Libby Loadout in Libby, the Bear Creek Road/U.S. 2 intersection, and to the Sedlak Park Substation (MP 60.3) in the right-of-way of Montana Department of Transportation (MDT) and under its jurisdiction. NFS road #6210 (between Ramsey Creek and Libby Creek) would be used as an access road to the Libby Adit. While the Bear Creek Road is upgraded in the first 2 years, NFS road #231 (Libby Creek Road) would be used for access.

In Alternatives 3 and 4, MMC would use the same segment of U.S. 2 between Libby and the intersection with Bear Creek Road, and the Bear Creek Road to the tailings impoundment site. As

in Alternative 2, the Bear Creek Road would be paved with chip-seal and upgraded to 26 feet wide. New segments of access road would be needed.

During transmission line construction, MMC would use U.S. 2 from Libby to Sedlak Park (MP 58.8). Depending on the transmission line alternative selected, MMC would use other NFS roads, such as the Miller Creek Road (NFS road #385), or the Libby Creek Road (NFS road #231). Proposed road use and new road construction in each transmission line alternative is discussed in Chapter 2. None of the new roads would be open to public access and only used for access to the transmission line. Effects of the new roads are discussed where appropriate in various resource sections, such as sections 3.14, *Land Use;* 3.18, *Soils and Reclamation;* 3.21, *Vegetation;* and 3.24, *Wildlife Resources*.

No airports, air strips, helipads, or metal pipelines are in the analysis area; these areas are not discussed further. Ken Justice, a pilot with the ALERT Air Ambulance Service at the Kalispell Regional Medical Center indicated U.S. 2 is not used as a corridor for helicopters and that the preferred route is the Kootenai River corridor (Justice 2008). No railroads are near the mine area or transmission line corridors. Concentrate would be shipped via rail from the Libby Loadout. MMC's concentrate shipments would be very small, and effects on rail traffic are not discussed further.

3.20.2.2 Methods

To establish the base traffic conditions, the amount of traffic on the roadway system during the time period of the proposed mine operations without mine-related traffic was estimated. The proposed mine traffic was then added to the base levels, and the extent to which the mine traffic affects the service level of the roadway network was then determined. Safety was analyzed by calculating the additional number of accidents that may result from the increases in mine-related traffic. Intersections within the roadway network were examined to determine if the roadways need to be modified to accommodate increased levels of traffic. Because transmission line access roads would be used most heavily during construction and line decommissioning, and traffic volumes relatively would be small and short-term, an assessment of traffic congestion and safety was not completed on them.

3.20.2.2.1 Time Period

The analysis area includes the roadways to be used by mine traffic during start up, operating, and reclamation phases. For purposes of analysis, the lead agencies assumed construction would start in 2010. Mine start up construction activities would last 3 years until 2013. The mine would operate until 2029, for 16 years. Three additional years of operation may occur.

After operations are completed, the mine would be closed. Reclamation and monitoring activities would last 10 years, until 2039. Upon completion of mining operations, traffic volumes would be greatest during the first year for reclamation activities. Traffic would be minimal during post-closure monitoring activities. The analyses were projected for 19 years, starting in 2010. Although actual timelines for the mine may change from the timeline proposed (for example, if construction would start in 2012 instead of 2010), the magnitude and duration of the effects of mine-related traffic on the transportation system would remain relatively the same.

3.20.2.2.2 Traffic Volumes

MMC provided estimates of mine-related daily traffic volumes and vehicle types anticipated to use the roadway system during operation of the proposed mine (MMI 2005a, MMC 2008). The MDT and the KNF provided traffic data for U.S. 2 and National Forest System roads. MMC's volumes and types were added to the traffic data supplied by the MDT and the KNF. In addition to traffic data, the MDT supplied design plans for the segments of U.S. 2 from Libby to the Libby Creek Road turnoff; these design plans were used to complete the intersection safety analysis at U.S. 2 and Bear Creek Road.

3.20.2.2.3 Traffic Congestion

The quality of service that a roadway provides is a measure of the amount of traffic congestion on a roadway for a particular volume of traffic. The quality of service is measured using the concept of levels of service (LOS). Six LOSs are as defined by the Transportation Research Board (TRB) in the Highway Capacity Manual. The six LOSs are A, B, C, D, E, and F, with LOS of A being the least congested, or best condition, and LOS of F being the most congested, or worst condition. Any roadway section determined to be functioning at LOS A, B or C is considered to be operating acceptably (Highway Capacity Manual 2000).

An LOS analysis was completed for U.S. 2 and for the intersection of U.S. 2 and Bear Creek Road. These analyses were completed for peak hour traffic during the day and represent the maximum amount of traffic congestion expected. For most of the time, the roadways would not experience the peak hour traffic used in the analysis.

For two-lane highways, such as U.S. 2, each LOS is defined by percent time spent following another vehicle and average travel speed, as shown in Table 137. U.S. 2 is a class 1 highway, which is as a highway where efficient mobility is paramount. For intersections without traffic lights, such as the two-way, stop-controlled (TWSC) intersection at U.S. 2 and Bear Creek Road, each LOS is defined by a range of delay times, measured in seconds that an individual vehicle will experience completing an individual turning movement during the peak hour volume (Highway Capacity Manual 2000). The LOS criteria for TWSC intersections are also shown in Table 137. The intersection of U.S. 2 and the Libby Loadout access road was not analyzed due to the low level of anticipated use by MMC-related vehicles, which would be about one truck per hour during day shift operating hours.

The intersections of U.S. 2 and Libby Creek Road and U.S. 2 and the proposed Sedlak Park substation access did not warrant analysis because the limited amount of traffic that would use them during construction activities would not affect the operation of the intersection. Congestion on Bear Creek Road and Libby Creek Road also was not analyzed because the Highway Capacity Manual analysis methods do not apply to recreational roads. A recreational road is not used for mobility, or to get from point A to point B in the fastest time, which is the basis of the two-lane highway analysis in the Highway Capacity Manual.

3.20.2.2.4 Safety

The safety of a particular section of highway is measured by the number of crashes per million vehicle miles traveled, called the accident rate. Typically, if there are no changes to a portion of highway that could affect the number of crashes and the roadway congestion is not severe, then as the amount of traffic increases, the number of accidents also increases proportionally by the accident rate. Because the proposed mine project would result in increased traffic on the area

roadways, the number of accidents also may increase. The additional number of accidents that may result from the mine-related traffic was calculated for existing and future traffic conditions.

The intersection of U.S. 2 and Bear Creek Road also was analyzed to determine if the intersection met current sight distance requirements and if turning lanes were required based on additional mine-related traffic. The sight distance and turning lane requirements for the intersection were analyzed using current MDT design criteria from the Montana Road Design Manual (MDT 2000).

Table 137. Level of Service Criteria Used in Congestion Analysis.

Level of Service	Criteria for Two-Lane Highways in Class 1		Criteria for TWSC Intersections
	Percent Time Spent Following	Average Travel Speed (mph)	Average Control Delay (sec/vehicle)
A	< 35	> 55	0 to 10
B	> 35 to 50	> 50-55	>10 to 15
C	> 50 to 65	> 45 to 50	>15 to 25
D	> 65 to 80	> 40 to 45	>25 to 35
E	> 80	> 40	> 35 to 50
F	Applies whenever the flow rate exceeds the segment capacity		> 50

TWSC = two-way, stop-controlled.
Source: Highway Capacity Manual 2000.

3.20.3 Affected Environment

3.20.3.1 U.S. 2

U.S. 2 is a Non-Interstate National Highway and the northernmost U.S. highway. It provides access for eastbound and westbound travel across the continental United States. In Montana, the MDT classifies U.S. 2 as a principle arterial.

Average annual daily traffic (AADT) volumes at three locations along U.S. 2 near the intersection of U.S. 2 and NFS road #278 (Bear Creek Road) from 1997 through 2004 were provided by the MDT (Table 138). The data were used to develop traffic growth rates for each section of roadway in the analysis. The AADTs increase toward the city of Libby and more than double from the east side of the intersection with State Highway 482 (MP 36.0) in the town of White Haven to the west side (MDT 2006).

Within the analysis area, from the city of Libby (MP 32.7) to the intersection with Montana Highway 482 in the city of White Haven (MP 36.1), U.S. 2 is a two-way, four-lane, undivided highway with a total width of 68 feet. The road consists of 12-feet travel lanes, 10-feet shoulders, and is bounded on both edges by curb and gutter. South of the intersection with Highway 482, U.S. 2 reduces in width to a two-way, three-lane, undivided highway. The eastbound direction remains at two lanes to MP 36.6. The westbound direction is a single travel lane. The roadway

edges change from a curb and gutter to a shoulder and ditch section. At MP 36.6, U.S. 2 reduces to a two-way, two-lane highway that is a total width of 46 feet and consists of 12-feet travel lanes and 11-feet shoulders. The shoulder width remains 11 feet until MP 37.4, where it reduces to 1.5 feet. The narrow shoulder condition continues to Libby Creek Road.

Table 138. Average Annual Daily Traffic on U.S. 2 near the Bear Creek Road Intersection.

Milepost/ Year	Average Annual Daily Traffic (vehicles/day)							
	1997	1998	1999	2000	2001	2002	2003	2004
35.3	4,920	5,940	8,260	4,800	4,800	5,290	5,270	5,660
37.5	2,470	2,140	3,820	2,060	No Data	2,350	2,220	2,290
40.0	1,570	1,410	1,220	1,740	2,000	1,740	1,550	1,880

Note: 1997 to 1999 data at MP 35.3 and 37.5 not used in analysis due to anomalously high fluctuations
Source: MDT 2006.

Proceeding east from the city limit boundary for the town of Libby, the posted regulatory speed limit is 40 mph to MP 33.4 (0.6 mile), increases to 50 mph to the end of the three-lane roadway section at MP 36.4 (east of White Haven), and increases to 70 mph for passenger vehicles, and 65 mph for trucks on the remainder of the two-lane roadway within the analysis area. The roadway surface is asphalt. Based on roadway plans provided by MDT, the roadway geometry is curvilinear and the terrain is level between Libby and White Haven and rolling east of White Haven. Initially constructed in the 1930s, the road was resurfaced and rehabilitated in 1998 and 1999.

Accident information including accident rates for U.S. 2 from MP 32.7 to MP 40.0 was supplied by MDT. Accident information is presented in Table 139. The accident rate for U.S. 2 between MP 32.7 to MP 40 is 1.12 accidents per million vehicle miles traveled for the 7-year period 2001 to 2007. The accident rate for all rural non-interstate national highways in Montana from 2000 to 2004 was 1.24 accidents per million vehicle miles traveled. From 2001 to 2005, one accident occurred at the intersection of U.S. 2 and Bear Creek Road. It was a single vehicle accident that involved a right turning vehicle that lost control. At the time of the crash, the roadway surface was snow packed (Jomini 2006a, 2006b). No data for crash rates on Bear Creek Road or Libby Creek Road are available.

3.20.3.2 NFS Road #278 (Bear Creek Road)

Bear Creek Road intersects U.S. 2 at MP 39.7, 7.0 miles east of the Libby city limit boundary. It functions primarily as a recreational road, providing access to the KNF. The first 0.75 mile of Bear Creek Road is a two-way, two-lane roadway with a total width ranging from 18 to 20 feet. The remainder of the roadway is two-way, single-lane with a total width of about 14 feet. The first 9.5 miles has a chip-seal paved surface that is in poor condition. Bear Creek Road crosses Bear Creek at MP 9.5; the bridge across Bear Creek is 14 feet wide. The remainder of the road is a native (dirt) surface. The roadway geometry is curvilinear with various curves in several locations. The roadway profile is mountainous.

Table 139. U.S. 2 Accident Data (MP 32.7 to MP 40.0).

Year	Total Number of Crashes	Total Number of Fatal Crashes	Total Number of Injury Crashes	Total Number of Property Damage Only Crashes
2001	11	0	6	5
2002	13	0	9	4
2003	17	0	4	13
2004	8	0	3	5
2005	11	0	7	4
2006	15	1	7	7
2007	18	0	6	12
Total	93	1	42	50

MP = milepost.
Source: Jomini 2006a, 2006b.

Because the roadway is not an all-weather road (Stantus, pers. comm. 2006b), it is closed during spring frost break-up for vehicles weighing over 10,000 pounds. All types of vehicles can travel on the roadway except when mud and snow conditions limit use to 4-wheel drive (USDA Forest Service *et al.* 1992). There has been little maintenance to the roadway and several areas of the roadway have settled due to subsurface instability.

Yearly traffic volumes supplied by the KNF from 1986 through 1991 (Table 140) were used to develop traffic growth rates and peak hour traffic volumes. ADT volumes from 1986 through 1990 also were provided by the KNF based on grizzly bear seasons: spring (April 1 to June 15), summer (June 16 to September 15), and fall (September 16 to September 30) (Table 140) (Lampton, pers. comm. 2006). According to the KNF, the actual existing volumes are likely lower than the provided volumes due to significant decreases in timber operations since 1991(Lampton, pers. comm. 2006).

Table 140. Estimated Yearly Traffic on Bear Creek Road.

Year	Traffic Volumes (vehicles/year)	Average Daily Traffic Based during Grizzly Bear Seasons (vehicles/day)†			
		Spring 4/1 - 6/15	Summer 6/16 - 9/15	Fall 9/16 - 9/30	Winter 10/1 - 12/31
1986	15,957	47	72	82	88
1987	18,773	40	80	96	107
1988	13,175	38	80	65	70
1989	17,355	50	88	98	87
1990	19,150	53	101	88	103
1991	13,615	47	72	69	72

†No traffic data were provided from January 1 to May 31.
Source: Stantus 2006a; Lampton 2006.

3.20.3.3 NFS Road #231 (Libby Creek Road)

Libby Creek Road intersects U.S. 2 at MP 42.0, 9.3 miles east of the Libby city limit boundary. It functions as a recreational road providing access to the KNF. Libby Creek Road has a two-way, two-lane width of 22 feet and a chip-seal paved surface for the first 0.5 mile. The road then narrows to a two-way, single-lane width varying from 14 to 16 feet with a gravel surface until the bridge at MP 9.2 (Lampton 2006). The speed limit in this section is 25 mph and the degree of intervisible turnouts is 75 percent; an intervisible turnout is an area designed to allow vehicles to pass and so spaced to provide visibility between the turnouts. At MP 9.2 (intersection with Bear Creek Road) and proceeding until MP 10.6, the road changes to a two-way, single-lane width of 12 feet and maintains the gravel surface. The speed limit is 20 mph and the degree of intervisible turnouts is 50 percent. From MP 10.6 to the end of the road, the roadway surface is native and the two-way, single lane roadway width is 12 feet. The speed limit is 15 mph and there are no intervisible turnouts (USDA Forest Service et. al. 1992). The roadway geometry is curvilinear with very sharp curves in several locations. The roadway profile is mountainous.

The Libby Creek Road is not built to an all-weather standard and, like Bear Creek Road, is closed during spring frost break-up to vehicles weighing over 10,000 pounds. All vehicles can generally use the roadway except during snow and mud conditions when travel is limited to 4-wheel drive (USDA Forest Service et. al. 1992). Culverts and surfacing have been replaced in the last 5 years (Stantus 2006b).

3.20.4 Environmental Consequences

3.20.4.1 Congestion

3.20.4.1.1 Alternative 1 – No Mine

Without the proposed mine, traffic on U.S. 2 from White Haven to Bear Creek Road would grow at an annual rate of 1.2 percent, increasing from 2,460 vehicles per day in 2010 to 3,085 vehicles in 2029. This would result in peak hour traffic of 370 vehicles per hour in 2010 and 465 vehicles per hour in 2029. For the entire 19-year period from 2010 to 2029, U.S. 2 would function at LOS C in this two-lane section of the roadway, due to the limited passing opportunities and the percent of time vehicles spent following other vehicles. Between Libby and White Haven, traffic would grow at 1.2 percent annually with traffic increasing from 5,075 vehicles per day in 2010 to 6,370 vehicles per day in 2029. Peak hour traffic would be 760 vehicles per hour in 2010 and 960 vehicles per hour in 2029. This four-lane section would operate at LOS A through 2027.

The seasonal average daily traffic (SADT) on Bear Creek Road is 127 vehicles per day in 2010. Without the proposed mine, traffic would grow at an annual rate of 2.0 percent increasing to 185 vehicles per day in 2029. No improvements would be completed to Bear Creek Road under this alternative. A negligible increase in traffic volumes along the Bear Creek Road and NFS roads #4781 and #6210 would occur during ongoing activities at the Libby Adit.

Peak-hour traffic entering U.S. 2 from Bear Creek Road would experience a LOS B through 2029. The increase in traffic also would not affect peak hour traffic turning left from U.S. 2 onto Bear Creek Road. It would experience a LOS A during the entire 19-year period from 2010 to 2029.

3.20.4.1.2 Alternative 2 – MMC's Proposed Mine

The low volume of traffic generated by the proposed mine would not adversely affect the operation of U.S. 2. The proposed mine would generate an additional 132 vehicles per day on U.S. 2, including 52 trucks and six buses. U.S. 2 would continue to function at LOS C during the peak hour period in the two-lane section during the entire 19-year period from 2010 to 2029. The additional mine-related traffic also would not affect the four-lane section of the roadway, which would still function at LOS A through 2027.

The addition of mine-related traffic to the existing traffic entering U.S. 2 from Bear Creek Road in 2010 would not affect the LOS and would remain LOS B during operations. Peak hour traffic turning left from U.S. 2 onto Bear Creek Road also would not experience a reduction in LOS due to the mine-related traffic and would still operate at a LOS A.

About 10 miles of the Bear Creek Road (NFS road #278), from U.S. 2 to the Bear Creek bridge, would be chip-and-seal paved and upgraded to 20 to 29 feet wide. Several short segments of the Bear Creek Road around the Little Cherry Creek Impoundment and Diversion Channel also would be realigned under this alternative. Reconstruction is anticipated to take 2 years. Public traffic and mine-related traffic required for construction of the mine facilities would use Libby Creek Road (NFS road #231) as the primary access to the KNF during the time that Bear Creek Road would be reconstructed. The reconstruction of Bear Creek Road would minimize future congestion because the roadway would be upgraded to a uniform width that would accommodate two-way traffic in separate lanes.

The Forest Service would require the MMC to obtain a road use permit prior to using Libby Creek Road during mine construction activities. The permit could include a monetary deposit for gravel replacement and conditions for dust control. Permit requirements would be determined by the level of use anticipated by MMC (Stantus 2006a).

Six roads currently open, Little Cherry Loop Road (NFS road #6212), a 1.6-mile long segment Little Cherry Bear Creek Road of (NFS road #5182), NFS road #8838, a 1-mile long segment Poorman Creek Road of (NFS road #2317), 0.2 mile of NFS road #5170, and a 0.7-mile long segment of Ramsey Creek Road (NFS road #4781), would be gated and used for mine traffic only during operations. The gates on the Little Cherry Loop Road (NFS road #6212) and the Poorman Creek Road (NFS road #2317) would be near the intersection with the Bear Creek Road on the north end and the tailings impoundment permit area boundary on the south end. Gating the Little Cherry Loop Road (NFS road #6212) would restrict motorized access to NFS roads #5182 and #8838. The gate on the Poorman Creek Road (NFS road #2317) would be near its intersection with the Bear Creek Road south of Poorman Creek. Gating the Poorman Creek Road (NFS road #2317) would restrict motorized access to the Ramsey Creek Road (NFS road #4781) and NFS road #5170.

At the end of operations, gates on formerly open roads would be removed and the roads would reopen to motorized access. A segment of the Little Cherry Loop Road (NFS road #6212) would be covered by the tailings impoundment and would not provide a loop between the Bear Creek Road. Traffic on the segment of the Bear Creek Road between Poorman and Bear creeks would increase over the long term due to the loss of the Little Cherry Loop Road beneath the impoundment.

3.20.4.1.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would have similar effects on congestion and level of service as Alternative 2. The addition of mine-related traffic to the existing traffic entering U.S. 2 from Bear Creek Road in 2010 would maintain LOS B during operations. Creation of a supply staging area in Libby and consolidating shipments to the mine area would slightly reduce traffic from that estimated for Alternative 2.

The public and mine traffic would use the new Libby Plant Access Road (Figure 30). The abandoned Bear Creek Road (NFS road #278) between the Libby Plant Access Road and just north of Poorman Creek would be gated during operations and decommissioned at closure. The gates on the Little Cherry Loop Road (NFS road #6212) would be near the tailings impoundment permit area boundary on the north end and near its intersection with the Bear Creek Road south of Poorman Creek on the south end. The existing bridges across Poorman Creek on the Bear Creek Road (NFS road #278) and the Little Cherry Loop Road (NFS road #6212) would be removed at closure. Connection between the Bear Creek Road and the Libby Creek Road (NFS road #231) would be maintained via the new Libby Plant Access Road and the Poorman Creek Road (NFS road #2317).

The Poorman Creek Road would remain open to motorized access from the intersection with the Bear Creek Road to its current closure location at the intersection of NFS road #2317B. A small parking area would provide parking for non-motorized access up Poorman Creek.

At the end of operations, gates on formerly open roads would be removed and the roads would reopen to motorized access. A segment of the Little Cherry Loop Road (NFS road #6212) would be covered by the tailings impoundment and would not provide a loop between the Bear Creek Road. Traffic on the segment of the Bear Creek Road between Poorman and Bear creeks would increase over the long term due to the loss of the Little Cherry Loop Road beneath the impoundment. About 3.2 miles of the Ramsey Creek Road (NFS road #4781) would be barriered and closed to administrative use for grizzly bear mitigation in Alternative 3. This change would reduce administrative access to the Ramsey Creek drainage.

3.20.4.1.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would have similar effects on congestion and level of service as Alternative 2. The addition of mine-related traffic to the existing traffic entering U.S. 2 from Bear Creek Road in 2010 would remain at LOS B during operations.

The gates on the Little Cherry Loop Road (NFS road #6212) and the Poorman Creek Road (NFS road #2317) would be near the intersection with the Bear Creek Road on the north end and the tailings impoundment permit area boundary on the south end. Gating the Little Cherry Loop Road (NFS road #6212) would restrict motorized access to NFS roads #5182 and #8838.

The Poorman Creek Road would remain open to motorized access from the intersection with the Bear Creek Road to its current closure location at the intersection of NFS road #2317B. A small parking area would provide parking for non-motorized access up Poorman Creek.

At the end of operations, gates on formerly open roads would be removed and the roads would reopen to motorized access. A segment of the Little Cherry Loop Road (NFS road #6212) would be covered by the tailings impoundment and would not provide a loop between the Bear Creek Road. Traffic on the segment of the Bear Creek Road between Poorman and Bear creeks would

increase over the long term due to the loss of the Little Cherry Loop Road beneath the impoundment. About 3.2 miles of the Ramsey Creek Road (NFS road #4781) would be barriered and closed to administrative use for grizzly bear mitigation in Alternative 4. This change would reduce administrative access to the Ramsey Creek drainage.

3.20.4.1.5 Alternative A – No Transmission Line

Without the traffic related to the transmission line initial construction and continued operations and maintenance, the LOS on U.S. 2 and related roadways would operate at acceptable levels, similar to those experienced on U.S. 2 without the mine-related traffic. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

3.20.4.1.6 All Transmission Line Alternatives

The traffic generated by the initial construction, continued operations and maintenance and final decommissioning of any of the transmission line alternatives would have no significant effect on the traffic congestion of the affected roadways and intersections due to the low volumes of traffic generated. Short, intermittent delays on U.S. 2 would occur during transmission line stringing operations. Guard structures would be placed on either side of U.S. 2 to prevent the line from failing across the highway. Similar delays would occur and similar procedures would be used on currently open NFS roads, such as NFS road # 231 or #385, used in the construction of the transmission line. Similar short, intermittent delays on U.S. would occur during the initial months of construction of the Sedlak Park Substation Site. These delays would not adversely affect traffic congestion on U.S.

3.20.4.2 Safety

3.20.4.2.1 Alternative 1 – No Mine

By the end of 2010, between the eastern city limit of Libby to the town of White Haven, U.S. 2 is projected to have experienced an estimated 7 accidents without mine traffic. For 2010, U.S. 2 will have experienced 3 accidents from White Haven to Bear Creek Road. In 2029, the accidents between Libby and White Haven would increase to 9 accidents and 4 accidents between White Haven and Bear Creek Road. The increase in accidents would be due to the increase in traffic volumes during that same period.

3.20.4.2.2 Alternative 2 – MMC's Proposal

On U.S. 2, the proposed mine would generate an additional 132 vehicles per day over the base traffic levels without the mine and would result in an additional 0.4 accidents per year from 2010 to 2029, for a total of 8 additional accidents over the 19-year life of the proposed mine. The increased number of accidents would be due to the increase in traffic volumes, would be short-term, and would return to a number without the mine at the end of the project.

The intersection of U.S. 2 and Bear Creek Road meets current MDT sight distance requirements for left and right turning vehicles from Bear Creek Road onto U.S. 2. The intersection also meets the stopping sight distance requirements for vehicles turning from U.S. 2 onto Bear Creek Road. Turn lanes for eastbound U.S. 2 traffic turning right onto Bear Creek Road and westbound U.S. 2 traffic turning left onto Bear Creek Road would not be warranted based on the expected traffic

levels in 2010 or 2029. The Bear Creek Road is a public approach to U.S. 2. The approach would need to be evaluated for an Interstate Truck and Trailer Combination (AASHTO 2004 Greenbook WB-20 (WB-65 and WB-67)). If the approach did not meet the design requirements for a WB-67 design vehicle, modifications to the intersection would be required. The approach would be designed not to affect the transportation system level of service or safety in the analysis area.

On the Bear Creek Road and the Libby Creek Road, no accident data are available to calculate the anticipated number of accidents due to the increase in traffic from the proposed mine. On Bear Creek Road, MMC would reconstruct the segment between U.S. 2 and the Bear Creek bridge to a consistent two-lane width that is appropriate for two-way traffic to pass unobstructed. The effects of the Bear Creek Road reconstruction would eliminate any significant transportation safety impacts related to mine-related traffic. The minimal mine-related traffic on Libby Creek Road during the time period that Bear Creek Road is being reconstructed would have no adverse effect on the safety of Libby Creek Road.

MMC would reconstruct the Bear Creek Road from U.S. to the Ramsey Access Road to a roadway width of 20 to 29 feet. Mine haul traffic and public traffic would share two segments of roads, a 2.5-mile segment of the Bear Creek Road between the Little Cherry Creek Impoundment Site to the Ramsey Access Road and a 0.6-mile segment of NFS road #2316 east of the Libby Adit Site (Figure 30). MMC's proposed widths would not safely accommodate mine haul traffic and public traffic. The Mine Safety and Health Administration (Mine Safety and Health Administration 1999) recommends a road width of 56 feet wide to accommodate joint-use traffic safely.

MMC would inspect the Bear Creek bridge for load capacity, but expects it would be sufficient for mine use. The bridge width, which is currently 14 feet, would be inconsistent with the width of the improved Bear Creek Road. Because mine traffic and public traffic would share the Bear Creek Road north of the Little Cherry Creek Impoundment, the narrow bridge width may lead to safety concerns.

The Bear Creek Road between the intersection with Libby Creek Road and the new Ramsey Plant Access Road would not be reconstructed and would remain in its current unpaved condition.

3.20.4.2.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative and Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

These alternatives would have the same effect on the number of accidents on U.S. 2 as Alternative 2. Public and mine haul traffic would share 1.8 miles of road in Alternative 3 and 3.8 miles of road in Alternative 4 (Figure 39). The joint-use road segments would be widened to widths recommended by the Mine Safety and Health Administration (Mine Safety and Health Administration 1999). For a 16-foot wide haul vehicle, the road width would be 56 feet wide to safely accommodate joint-use traffic. All bridge would be reconstructed to a width compatible with the reconstructed width of the adjacent road segment. A wider road width would safely accommodate joint-use traffic. The new bridges would be long enough to convey a 100-year flow event, to comply with INFS standards. A reconstructed bridge at Bear Creek would be safer than the existing bridge.

In Alternative 3, MMC would surface the existing NFS road #278 (Bear Creek Road) from the junction with NFS road #2317 to NFS road #231 (Libby Creek Road) with 6 inches of gravel 16 feet wide (Figure 39). Similarly, would surface the Bear Creek Road from new Libby Plant access

road to the Libby Creek Road in Alternative 4 (Figure 39). This surfacing would ensure the safe transition from the improved section north of the new Libby Plant Access Road and the unimproved section to the Libby Creek Road.

3.20.4.2.4 Alternative A – No Transmission Line

Without the traffic related to the transmission line, initial construction and continued operations and maintenance, the safety on U.S. 2 and related roadways would be similar to those experienced on U.S. 2 without the mine-related traffic. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

3.20.4.2.5 All Transmission Line Alternatives

None of transmission line alternatives would result in adverse impacts to the safety of the transportation network due to the minimal volume of traffic that would be generated by the transmission line construction, continued operations and maintenance, and final decommissioning. The approach to the Sedlak Park Substation would be designed not to affect the transportation system level of service or safety in the analysis area.

3.20.4.3 Cumulative Effects

The KNF's Miller-West Fisher Vegetation Management Project will consist of vegetative treatments including timber harvest, slash treatment, site preparation, prescribed burning, tree planting, precommercial thinning, construction of new roads, road storage and decommissioning activities, road reconstruction, and implementation of best management practices. Depending on the timing of these activities and construction of the transmission line, traffic volumes may be cumulatively greater in the Miller Creek and West Fisher Creek drainages. Many of the other reasonably foreseeable actions would use the same roads as the Montanore Project. The reasonably foreseeable actions and the Montanore Project would cumulatively increase traffic volumes near access roads. The additional traffic would not adversely affect the level of service on U.S. 2 or lead to adverse congestion. The Libby Port Authority will construct a new approach road to the Kootenai Business Park. The approach would be designed not to affect the transportation system level of service or safety in the analysis area.

3.20.4.4 Regulatory/Forest Plan Consistency

All action alternatives would be consistent with the KFP standards regarding roads, regulations governing the administration of the Forest Transportation System (36 CFR 212), and with the Forest Service Transportation Administrative Policy FSM Chapter 7700 (2001). All roads to be built for the project would be constructed, maintained, and decommissioned to minimize adverse environmental impact. Only the minimum number of roads would be constructed to the minimum standard necessary. Unneeded roads used during construction would be decommissioned. KNF Compliance with INFS standards applicable to roads have been discussed in section 3.6, *Aquatic Life and Fisheries.*

3.20.4.5 Irreversible and Irretrievable Commitments

All mine alternatives would increase traffic on the roadways, thereby increasing the fuel used by vehicles beyond the no-mine alternative. Fuel is a non-renewable resource; thus, an increase in traffic related to the mine alternative would result in an irreversible commitment of resources. All mine alternatives would increase the number of accidents during the mine's operation and closure. Increased accidents would be an irreversible commitment of resources.

3.20.4.6 Short-term Uses and Long-term Productivity

During the mine's and transmission line construction, operation and closure, increased traffic congestion and accidents could occur on roads and highways used in the project, and would cease at the end of the closure period.

3.20.4.7 Unavoidable Adverse Environmental Effects

During the mine's operation and closure, traffic congestion and accidents would occur on roads and highways used in the project. Increased congestion and accidents would cease at the end of the closure period.

3.21 Vegetation

The section describes the effects on four separate resources: vegetation communities; old growth ecosystems; threatened, endangered, and sensitive; and noxious weeds. Scientific names of plants are provided in the Vegetation Update Report (Westech 2005d). Section 3.22, *Wetlands and Other Waters of the U.S.* discusses effects on wetland plant communities.

3.21.1 Vegetation Communities

3.21.1.1 Regulatory Framework

The National Forest Management Act (NFMA) prescribes specific management goals on National Forest System lands. The primary objective of the NFMA is to establish land and resource management planning guidelines, goals, and objectives to achieve effective and balanced uses while protecting renewable resources on National Forest System lands. Under NFMA, Forest Plans shall "provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives." (16 USC 1604(g)(3)(B)).

In addition to the NFMA, the KNF vegetation management practices are developed according to guidelines and goals established in the KFP. Riparian areas within the KNF are managed according to RMOs established in the INFS. The RMOs and RHCAs have been discussed in section 3.6, *Aquatic Life and Fisheries*.

For lands affected by the transmission line, the MFSA directs the DEQ to approve a facility if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impacts, considering the state of available technology and the nature and economics of the various alternatives.

3.21.1.2 Analysis Area and Methods

The analysis area consists of all areas that would be disturbed by facility construction under any alternative (Figure 83). The vegetation at the Libby Loadout has been completely disturbed and the loadout is not discussed further. Vegetation mapping for the analysis area was obtained from baseline inventories (Western Resource Development 1989d, 1989e; Westech 2005d, Geomatrix 2007e; Hydrometrics Inc. in MMI 2005a). Vegetation community mapping for previously harvested coniferous forest was obtained directly from the KNF harvest GIS data layer. In calculations for effect, previously harvested coniferous forest took precedence over wetland/riparian mapping when areas overlapped. All areas that were determined not to be previously harvested coniferous forest or wetland/riparian were mapped as coniferous forest vegetation community.

Impacts of the mine alternatives on vegetation communities were determined by calculating the number of acres that would be disturbed. The mine reclamation plans of the alternatives also were compared. The analysis of transmission line effects calculated the total acreage within the clearing width of each alternative. Actual acreage cleared would be less and would depend on tree height, slope, and line clearance above the ground. Vegetation communities affected by road construction for transmission line access were calculated for each alternative. For analysis

purposes, it is assumed that minor disturbances of vegetation from staging and yarding areas and stringing, and tensioning sites would occur within the clearing width.

3.21.1.3 Affected Environment

Vegetation communities have developed across the landscape in response to climate, disturbance, and other environmental factors. Historically, dominant forest species were long-lived species such as white pine, western larch, ponderosa pine, and whitebark pine. Currently, the forest stands in the analysis area are dominated by short-lived seral species such as Douglas-fir, lodgepole pine, grand fir, and western hemlock. Changes in composition are due primarily to past management activities such as timber harvesting and fire suppression (USDA Forest Service 2001). Three dominant vegetation communities—coniferous forest; previously harvested coniferous forest; and wetlands including riparian areas—are documented in the analysis area; a total of 410 species were observed (Westech 2005d). Vegetation communities observed and documented in the analysis area are shown in Figure 83 and summarized below.

3.21.1.3.1 Coniferous Forest

About 50 percent of the analysis area is composed of coniferous forest vegetation communities including unlogged areas. Coniferous forests have large economic potential associated with timber harvesting and provide habitat for a variety of wildlife and plant species. Timber harvesting occurs mainly where the dominant tree species are western hemlock, western red cedar, grand fir, Engelmann spruce, Douglas-fir, lodgepole pine, and western larch (Westech 2005d).

Stand structure within the KNF varies from new growth to old growth managed areas. Within the coniferous forest vegetation communities, the KNF has identified stands of old growth that are managed to maintain diversity and habitat for wildlife and plant species. Old growth ecosystems and the habitat they provide for wildlife species are described in section 3.21.2, *Old Growth Ecosystems*.

The KNF has established Vegetative Response Units (VRUs) to aggregate lands having similar management potential and to assist the KNF in preparation of site-specific prescriptions. The VRU system can help interpret vegetation community response to natural disturbance and project future landscapes based on current conditions. The major VRUs in the analysis area are VRU5S and VRU5N, which are moderately cool and moist ecosystems (USDA Forest Service 1999b).

3.21.1.3.2 Previously Harvested Coniferous Forest

The previously harvested coniferous forest vegetation community includes all areas where trees have been harvested and/or clear cut. Most previously harvested areas have well-established conifer regeneration with western larch, western white pine, grand fir, and lodgepole pine. Higher-elevation areas are dominated by Engelmann spruce and subalpine fir, while lower-elevation areas are dominated by Douglas-fir, lodgepole pine, and ponderosa pine. As with the coniferous forest vegetation type, understory composition and cover varies considerably with site conditions, elevation, tree cover, and stand age. In younger previously harvested coniferous forest areas, more introduced species and noxious weeds are present than in older harvested areas (Westech 2005d).

3.21.1.3.3 Wetlands and Riparian Areas

Within the analysis area, wetlands and riparian vegetation communities are present along most streams and rivers. Wetlands are also found in depressions at both tailings impoundment sites, and along the transmission line alternatives. Wetlands and wetland vegetation are discussed in section 3.22, *Wetlands and Other Waters of the U.S.*

Riparian areas along Fisher River, Libby Creek, and Miller Creek support several riparian/wetland vegetation communities including riparian coniferous forest, cottonwood forest, shrub thickets, and herbaceous fringes. Riparian coniferous forest includes western red cedar, western hemlock, and Engelmann spruce with understory species of ladyfern, devil's club, oakfern, common horsetail, and Rocky Mountain maple. Riparian cottonwood forests are present along Fisher River, where black cottonwood and ponderosa pine are the dominant tree species with common snowberry, alder buckthorn, and Wood's rose making up the understory. Other herbaceous species include introduced reed canarygrass, native fowl bluegrass, and introduced common tansy, a noxious weed. Shrub thickets are present along the Fisher River, Miller Creek, and upper elevation streams with stands of Douglas spirea, thinleaf or Sitka alder, and alder buckthorn.

3.21.1.3.4 Other Vegetation Communities

Other vegetation communities in the analysis area are present in small quantities (Westech 2005d). Mapping of these vegetation communities has been consolidated with more dominant vegetation communities in the analysis area. These small vegetation communities are described below.

The shrub-field vegetation community is found in avalanche chutes where rock outcrops, talus, or scree are present. The shrub-fields are periodically destroyed by avalanche and have low cover and low tree density. Shrub species include Rocky Mountain maple, common snowberry, white spirea, pachistima, serviceberry, and bristly Nootka rose. For analysis purposes, the shrub-field vegetation community was included in the coniferous forest community.

The grassland community is found on steep convex ridges or slopes. Dominant grass species are natives including Idaho fescue, purple reedgrass, and elk sedge. Other common herbaceous species are clubmoss, fescue sandwort, yellow buckwheat, Sandberg's lomatium, Alberta penstemon, and western groundsel. For analysis purposes, the grassland community was included in the previously harvested coniferous forest community.

The Libby Adit Site, which is private land, was revegetated, reclaimed, and subsequently has been redisturbed by MMC. The disturbed mining area is dominated by introduced forbs such as birdsfoot trefoil and Dutch clover. Grasses such as introduced red fescue and native big bluegrass also are present. Some native forbs and noxious weeds such as spotted knapweed have established as well as some tree species. For analysis purposes, the area disturbed at the Libby Adit Site was included in the previously harvested coniferous forest community.

3.21.1.3.5 Agricultural Land

Agricultural land used for livestock grazing is located along the Fisher River and along the Bear Creek Access Road. Dominant species include introduced timothy, Kentucky bluegrass, orchard grass, white Dutch clover, and red clover. For purposes of analysis, agricultural land areas were combined with previously harvested coniferous forest community.

3.21.1.4 Environmental Consequences

3.21.1.4.1 Alternative 1 – No Mine

The No Mine Alternative would not remove or affect any vegetation communities or individual species. Monitoring wells installed as part of the baseline monitoring would be removed and the area reclaimed. Disturbances on private land at the Libby Adit Site would remain until reclaimed in accordance with existing permits and approvals. Introduced species would continue to increase from current disturbance areas.

3.21.1.4.2 Alternative 2 – MMC's Proposed Mine

Alternative 2 would result in the removal and loss of vegetation communities on up to 2,581 acres during mine operations (Table 141). The coniferous forests vegetation community would be most affected, with up to 1,560 acres disturbed. The coniferous forest vegetation communities include old growth stands, which are discussed in section 3.21.2, *Old Growth Ecosystems*. Previously harvested coniferous forest would be the second largest vegetation community impacted, with a disturbance of 949 acres. About 72 acres of riparian and wetland areas would be affected by Alternative 2. Alternative 2 would affect more coniferous forest communities and riparian areas than the other alternatives. Effects on other vegetation communities would be minor.

Table 141. Vegetation Communities within Mine Alternative Disturbance Areas.

Vegetation Community	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Coniferous Forest	1,560	971	1,094
Previously Harvested Coniferous Forest	949	1,035	1,102
Wetland/Riparian Areas	72	5	58
Total	2,582	2,011	2,254

All units are acres.
Source: GIS analysis by ERO Resources Corp. using vegetation mapping in Westech 2005d.

Areas in Alternative 2 that require vegetation clearing and removal would be subject to an overall loss of biodiversity and a change in species composition during mine operations. Reclamation would re-establish plant communities but the biodiversity would be less, introduced species would be more common, species composition would not be the same, and timber production would be lost until the seral forest re-established after several decades. Westech (2005d) documented 410 different plant species in the analysis area. After reclamation of mine disturbances, a forest can take many years to re-establish a community with a diversity of plants similar to but less than the original plant community. Competitive introduced species would limit the ability of native grasses and especially forbs to re-establish after the disturbance. This is an unavoidable impact of allowing the mine disturbance. Vegetation communities designated as previously harvested coniferous forest or areas proposed for merchantable timber sales would have a loss of productivity throughout mining and the KNF would have an overall net loss in timber sales until timber regenerated.

The LAD Areas would experience a change in species composition during water application and may again after water application was discontinued. If not managed properly, the LAD Areas may become dominated by species that favor seasonally saturated conditions, especially introduced species.

Interim reclamation would be used to revegetate disturbances from activities such as road cut and fill slopes and other temporary disturbances. In these locations, vegetation cover would return more quickly than those disturbed by mine operations. Some of the species in the interim mixture are introduced species. Upon completion of mining, disturbed areas would be reclaimed and revegetated. MMC's reclamation goal is to establish a post-mining environment comparable with existing conditions. The reclamation plan includes areas designated for reforestation, shrubs, or grasslands.

The permanent seed mix for Alternative 2 would be dominated by native species but more aggressive non-native species are included in the seed mix. In MMC's monitoring plan, three consecutive years of revegetation success would be achieved before bond release would be requested. Loss of native species and an increase in introduced species is an unavoidable impact of allowing the mine disturbance.

3.21.1.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would disturb up to 2,011 acres of vegetation (Table 141). The largest effect would be to the previously harvested coniferous forest vegetation communities (1,035 acres) and coniferous forest vegetation communities (971 acres). Timber would only be cleared in portions of the proposed LAD Area 2 if an additional water disposal area were needed. The impact to riparian and wetland areas would be about 5 acres and effects on other vegetation communities would be a small percentage of the disturbance. Effects on vegetation communities would be about 571 acres less than Alternative 2 because of a smaller Poorman Tailings Impoundment. The loss of biodiversity, increase in introduced species, change in species composition, and loss of timber production on disturbed lands until forest regeneration would be similar to that described for Alternative 2.

3.21.1.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would disturb up to 2,248 acres of vegetation, including 1,094 acres of coniferous forests and 1,102 acres of previously harvested coniferous forest (Table 141). The impact to riparian and wetland areas would be about 58 acres. Effects on loss of biodiversity, increase in introduced species, change in species composition, and timber production on disturbed lands would be similar to Alternative 2.

3.21.1.4.5 Alternative A – No Transmission Line

In Alternative A, the transmission line and substation for the Montanore Project would not be built. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

3.21.1.4.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Alternative B would have the least effect on vegetation communities compared to the other transmission line alternatives because of a narrower clearing width (150 feet compared to 200 feet). The coniferous forest vegetation communities would be most affected by Alternative B. About 139.5 acres of coniferous forests, 145.5 acres of previously harvested coniferous forest, and 12.3 acres of wetland and riparian areas could be cleared (Table 142). Actual clearing would likely be less than that shown in Table 142 depending on tree height, slope, and line distance above the ground. Construction of new access roads for transmission line installation and maintenance are estimated to affect about 9.7 acres of coniferous forest, 4.5 acres of previously harvested coniferous forest, and about 0.1 acre of wetland and riparian areas.

All disturbed areas would be interim seeded with grass and shrub species when construction of the transmission line and loop line was completed. Areas where trees would be trimmed, but otherwise not disturbed, would be allowed to establish naturally as grassland or shrubland. In accordance with BPA's health and safety policy, vegetation would be prevented from growing in the Sedlak Park Substation or within 5 feet of the substation fence. Within and outside the 100-foot right of way and within the 300-foot clearing width of the substation loop line, trees that pose a risk of falling on the transmission line would be cleared over the life of the line. Roads opened or constructed for transmission line access would be closed after transmission line construction was completed. The road surface would be reseeded as an interim reclamation measure designed to stabilize the surface. Where soil was salvaged from new roads, the road surface would be covered with soil and then reseeded. The new road prism would remain during transmission line operations. Introduced species would increase during mine life from the disturbance as well as from introduced species in the interim seed mix.

The BPA would clear all trees from its proposed 2-acre Sedlak Park Substation, including the access road between U.S. 2 and the substation. It also would clear the woody vegetation within the 300-foot-wide right-of-way for the loop line that would connect the substation to the Noxon-Libby Transmission Line, in order to construct, operate, and maintain the substation and loop line. Following the completion of mining activities, the BPA would dismantle the substation, remove the loop line, and revegetate the area assuming it had no need for these facilities.

During the final reclamation phase following mining, the transmission line would be removed, roads recontoured to match existing topography, trees along the line allowed to grow, and all disturbed areas revegetated. Grassland and shrub communities would be the quickest to establish; the coniferous forest community and riparian forest would take many years to establish because many species are relatively slow growing.

Effects on loss of biodiversity, increase in introduced species, change in species composition, and timber production on disturbed lands would be similar but less than mine Alternatives 2, 3, and 4. These are unavoidable impacts of allowing the transmission line construction.

3.21.1.4.7 Alternative C – Modified North Miller Creek Transmission Line Alternative

The use of a 200-foot clearing width for wooden H-frame structures for Alternative C would result in greater vegetation disturbance than Alternative B. About 166.7 acres of coniferous forest, 153.7 acres of previously harvested coniferous forest, and 4.6 acres of wetland/riparian areas would be cleared and would remain cleared over the life of the transmission line (Table 142). In Alternatives C, D, and E, a Vegetation Clearing Plan would be developed to minimize vegetation

clearing in sensitive areas, such as RHCAs. Use of a helicopter to clear timber and construct structures in areas near core grizzly bear habitat would minimize effects on vegetation communities in these areas. Road construction would affect about 2.3 acres of vegetation including about 1.3 acres of coniferous forests, and 0.9 acre of previously harvested coniferous forest and 0.1 acre of wetlands. New roads on National Forest System lands would be placed into intermittent stored service by using a variety of treatment methods after transmission line construction was completed. Trees would be planted in all areas where trees were removed for the construction of the transmission line including access roads and other disturbances such as line stringing and tensioning sites, slash burn piles, and construction pads. Trees would be planted at a density such that at the end of 5 years the approximate stand density of the adjacent forest would be attained at maturity. This standard would not apply to roads placed in intermittent stored status, but would apply when the roads would be decommissioned after the transmission line was restored. Planting trees in disturbances would require less time for trees to become establish, would better match surrounding landscape features, and would meet wildlife and density recommendations provided by the agencies.

Effects on loss of biodiversity, increase in introduced species, change in species composition, and timber production on disturbed lands would be similar to but less than mine Alternatives 2, 3, and 4, and similar to transmission line Alternatives B and C. These are unavoidable impacts of allowing the transmission line construction.

3.21.1.4.8 Alternative D – Miller Creek Transmission Line Alternative

Alternative D, with a clearing width of 200 feet would affect up to about 179.8 acres of coniferous forest and 148.6 acres of previously harvested coniferous forest, and about 14.0 acres of wetland/riparian areas (Table 142). Road construction would affect about 1.9 acres of vegetation including 1.2 acres of coniferous forest, 0.1 acre of wetlands and riparian areas, and 0.6 acre of previously harvested coniferous forest. Reclamation and transmission line decommissioning at the end of mining operations would be the same as Alternative C.

Effects on loss of biodiversity, increase in introduced species, change in species composition, and timber production on disturbed lands would be similar to but less than mine Alternatives 2, 3, and 4, and similar to transmission line Alternatives B, C, and D. These are unavoidable impacts of allowing the transmission line construction.

3.21.1.4.9 Alternative E – West Fisher Creek Transmission Line Alternative

Alternative E includes tree clearing widths of 150 to 200 feet, depending on location. Clearing could affect about 118.1 acres of coniferous forest and 28.6 acres of wetland/riparian vegetation over the life of the transmission line. This alternative would make the best use of existing timber harvest areas (207 acres) to reduce the amount of new tree clearing. Road construction would disturb about 1.7 acres of coniferous forest and 1.7 acres of previously harvested coniferous forest. Reclamation at the end mining operations would be similar to Alternatives B, C, and D.

Effects on loss of biodiversity, increase in introduced species, change in species composition, and timber production on disturbed lands would be similar to but less than mine Alternatives 2, 3, and 4, and similar to transmission line Alternatives B, C, and D. These are unavoidable impacts of allowing the transmission line construction.

Table 142. Vegetation Communities along Transmission Line Alternatives.

Type[†]	Alternative B – North Miller Creek	Alternative C – Modified North Miller Creek	Alternative D – Miller Creek	Alternative E – West Fisher Creek
Transmission Line Clearing Area				
Coniferous Forest	139.5	166.7	179.8	118.1
Previously Harvested Coniferous Forest	145.5	153.7	148.6	207.3
Wetland/Riparian	12.3	4.6	14.0	28.6
Subtotal	297.3	325.0	342.4	354.0
Areas Disturbed by New or Upgraded Roads				
Coniferous Forest	9.7	1.3	1.2	1.7
Previously Harvested Coniferous Forest	4.5	0.9	0.6	1.7
Wetland/Riparian	0.1	0.1	0.1	0.1
Subtotal	14.3	2.3	1.9	3.5
Sedlak Park Substation and Loop Line				
Coniferous Forest	0.5	0.5	0.5	0.5
Previously Harvested Coniferous Forest	3.9	3.9	3.9	3.9
Subtotal	4.4	4.4	4.4	4.4
Total	316.0	331.7	348.7	361.9

All units are acres, rounded to the nearest 0.1 acre.

[†]Acreage is based on a 150-foot clearing width for monopoles (Alternative B) and 200-foot width for H-frame structures (other alternatives except for a short segment of the West Fisher Creek Alternative that has monopoles). Actual acreage cleared would be less than listed and would depend on tree height, slope, and line clearance above the ground.

Source: GIS analysis by ERO Resources Corp. using KNF data, and vegetation mapping in Westech 2005d and MMI 2005b.

3.21.1.4.10 Cumulative Effects

Past actions, particularly timber harvest, road construction, wildfires, and fire suppression activities, have altered the vegetation communities in the analysis area. Vegetation cover and diversity in disturbed areas has decreased. Disturbances have increased the distribution of noxious weeds and other introduced species. In the areas surrounding the proposed Montanore Project, several projects would contribute to the cumulative effect on vegetation communities such as the Libby Creek Ventures Drilling Plan and the Miller-West Fisher Vegetation Management Project. These projects would result in various degrees of vegetation clearing, disturbance, and subsequent revegetation. The primary effects would include an incremental change in species composition from converting forests to an early successional stage or to grasslands and shrubland. These changes would cumulatively affect species biodiversity and productivity in the region.

3.21.1.4.11 Regulatory/Forest Plan Consistency

All alternatives would be in compliance with the KFP regarding vegetation communities. Under the proposed KFP amendment that would be implemented with each action alternative, the operating permit areas for the mine facilities and much of the transmission line corridors would be reallocated to non-timber production use. This change would be consistent with the KFP where management prescriptions are designed to preserve diversity for desirable plant species. Reclaimed plant communities would eventually re-establish diverse plant communities but the overall vegetation diversity would be less than the original plant communities and introduced species would increase. Compliance with the INFS and RHCA standards and guidelines have been discussed in section 3.6, *Aquatic Life and Fisheries*. Compliance with standards for old growth is discussed in section 3.21.2, *Old Growth Ecosystems*.

3.21.1.4.12 Irreversible and Irretrievable Commitments

All of the mine alternative and transmission line alternatives would disturb vegetation communities, most of which would be subsequently mitigated by revegetation. Revegetated areas would eventually return to predisturbance productivity, but vegetation diversity would be lower than existing conditions. Decreased production of timber during mine operations and for several decades after reclamation would be an irretrievable commitment of resources. The tailings impoundment areas, which would disturb about 600 acres in each mine alternative, would be managed for mineral development following operations, and would no longer be managed for timber production. The area covered by asphalt and gravel by widening the Bear Creek Road would not be returned to pre-mine uses. These effects would be an irretrievable commitment of resources. The loss of native plant species and increase in introduced species in all mine and transmission line alternatives would be an irreversible resource commitment.

3.21.1.4.13 Short-term Uses and Long-term Productivity

Mining operations and transmission line construction, operation, and decommissioning for all action alternatives would result in long-term impacts to vegetation communities and productivity. Productivity for forested areas would remain low following reclamation until new timber stands are established. A long-term loss of vegetation diversity from loss of native species would occur for each of the mine alternatives. Production of introduced species would increase on the disturbed areas.

3.21.1.4.14 Unavoidable Adverse Environmental Effects

An unavoidable loss of and change in vegetation during mining operations would occur. Reclamation of disturbed areas following mining would reclaim most areas to pre-mining vegetation conditions over the long term; communities would be altered and not all native species would re-establish. Introduced species would increase. This loss of some native species and increase in introduced species would be unavoidable impacts.

3.21.2 Old Growth Ecosystems

This section describes vegetative characteristics of old growth forests and features particularly important to wildlife. Old growth habitat is recognized for its unique ecological characteristics that serve as important habitat for both wildlife and some species of rare plants on the KNF. According to the KFP, 58 wildlife species use breeding and/or feeding habitat in old growth forest. While these species may not solely depend on old growth, they require old growth structure for part of their life cycle. Five species (barred owl, great gray owl, pileated

woodpecker, boreal red-backed vole, and brown creeper) have a strong preference or possible dependence on old growth.

The KFP identified the pileated woodpecker as the management indicator species for old growth forest habitat and all associated wildlife species (KFP, Appendix 12). For effects to old growth-associated wildlife species, refer to the pileated woodpecker analysis in section 3.24, *Wildlife Resources*. Forest sensitive species and State Species of Concern associated with old growth (flammulated owl, fisher, and northern goshawk) are also discussed in section 3.24, *Wildlife Resources*.

3.21.2.1 Regulatory Framework

The KFP establishes forest-wide goals, objectives, standards, guidelines, and monitoring requirements for old growth. According to KFP guidelines, "old growth should be recognized as an important habitat and managed to ensure its availability and utility to wildlife over time" (USDA Forest Service 1987). The following standards for old growth are in the KFP:

- To maintain a minimum of 10 percent of the KNF land base below 5,500 feet in elevation in old-growth timber condition
- To maintain an even distribution of old growth habitat through most major drainages, representing the major forest types in each drainage

KNF Supplement No. 85 to FSM 2432.22 direction is to ensure that a minimum of 10 percent old growth is designated for each 3rd-order drainage or compartment (or a combination thereof) before approving timber harvest (USDA Forest Service 1991).

A goal outlined in the KFP is to "Maintain diverse age classes…including old growth timber in sufficient quality and quantity to maintain viable populations of old growth dependent species and to maintain habitat diversity representative of existing conditions" (USDA Forest Service 1987). KFP direction specifies that old growth designated as MA 13 will "be managed to retain their old growth characteristics." MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*. Additional direction provided by Castaneda (2004) specifies that "harvest treatments in Forest Plan designated old growth stands (MA 13) will require a Forest Plan amendment."

The MFSA directs the DEQ to approve a facility if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impact, considering the state of available technology and the nature and economics of the various alternatives.

3.21.2.2 Analysis Area and Methods

The analysis area for evaluating direct and indirect impacts of the project on old growth in the KNF includes the Crazy and Silverfish Planning Subunits (PSUs), which are planning areas generally based on watersheds that encompass project facilities for all alternatives (Figure 84). The analysis area for evaluating direct and indirect impacts of the transmission line on old growth on private and state land consists of all non-National Forest System lands that would be disturbed by any of the alternative transmission line routes (Figure 84). The KNF and any non-National Forest System lands potentially disturbed by the alternative transmission line routes is the analysis area for cumulative effects to old growth.

Impacts of the mine alternatives on old growth were based on the area that would be disturbed by the mine features and associated roads. Transmission line impacts were based on the clearing width and new and improved roads associated with each alternative. Actual acreage cleared would be less and would depend on tree height, slope, and line clearance above the ground.

Management and characteristics of old growth are discussed and summarized in the KFP (Appendix 17, KFP II-1, 7, 22, KFP III-54), Green *et al.* (1992, errata corrected 2005), Pfister *et al.* (2000), Kootenai Supplement No. 85 to FSM 2432.22 (USDA Forest Service 1991), and Castaneda (2004), all of which are incorporated by reference. The KFP provides a description of old growth by habitat group (warm-dry, cool-moist, warm-moist). Since the release of the KFP, new information on old growth has become available. Pfister *et al.* (2000) conducted a peer review of documents that provide old-growth descriptions and attributes, and concluded that Green *et al.* (1992, errata corrected 2005) provides the best available source for identifying old growth. As a result, the KNF currently uses Green *et al.* (1992, errata corrected 2005) as the primary tool for identifying potential old growth stands.

Old growth stands on National Forest System lands were identified based on data from Ranger District files and surveys and the KNF old growth GIS layer. As specified in the KNF Supplement No. 85 to FSM 2432.22, old growth stands were field verified for the Crazy and Silverfish PSUs. Changes in old growth mapping resulting from recent field verification have not been incorporated into this Draft EIS. All old growth stands that have been field verified will be mapped and incorporated into impact calculations in the Final EIS. Field verification of old growth stands was completed using both walk-through and common stand exam methods, as described in the Vegetation Update Report (Westech 2005d). Stands above 5,500 feet are not suitable for reproduction of most old growth associated wildlife species (USDA Forest Service 1987), and are not included as part of the old growth MAs or calculations of old growth on the KNF.

Impacts of the alternatives on old growth on National Forest System lands were evaluated according to the following criteria:

- Acres of vertical structure removed in designated old growth. This is the area cleared of designated old growth, including both designated effective and designated replacement old growth
- Acres of vertical structure removed in undesignated effective old growth
- Road length built adjacent to or through designated old growth (in feet)
- Acres affected by edge in old growth
- Acres of interior habitat remaining in old growth
- Acres of old growth designated
- Percent of designated old growth remaining in the PSU

Effective old growth stands support the habitat conditions described in Green *et al.* (1992, errata corrected 2005). Replacement old growth stands do not have enough old growth characteristics to be considered old growth, but are expected to become old growth in time. Designated old growth consists of stands that have been given a specific MA designation, such as MA 13, as identified in the KFP. Effective old growth stands may have been identified after the KFP was published, and some have not been assigned to an old growth management area.

Research has indicated that certain activities, in particular regeneration harvest, within or adjacent to old growth stands may influence vegetative characteristics and wildlife use of those stands (Harris 1984; Ripple *et al.* 1991; Morrison *et al.* 1992; Province of BC 1995; Russell *et al.* 2000; Russell and Jones 2001). Although the width of old growth shown to be influenced by edge varies depending on the study (Chen *et al.* 1995), research supports a three-tree height rule of thumb as the distance to which effects occur (Harris 1984; Ripple *et al.* 1991; Morrison *et al.* 1992; Province of BC 1995; Russell *et al.* 2000). On the KNF, the average old growth tree height is 100 feet, based on the KNF Timber Stand Management Record System (TSMRS) database. Existing edge effects were estimated by applying a 300-foot buffer to harvested forest habitat (TSMRS activity codes 4100-4134) less than 30 years old and bordering old growth stands. Effects of alternatives were estimated by applying the same buffer to any resulting old growth edge. Old growth areas not affected by edge effects provide interior habitat.

Old growth mapping for private and state lands along the transmission line was based on photo-interpretation of 2006 aerial imagery and field verification conducted by a Forest Service biologist in 2008. Private land in the Little Cherry Creek impoundment disturbance area has been mostly harvested and was not surveyed for old growth. Impacts to old growth on private lands were evaluated based on the extent of mapped old growth affected.

3.21.2.3 Affected Environment

Old growth forest consists of mature and overmature stands that provide habitat for many wildlife species. The KFP Appendix 17, A17-2, classifies old growth as a "distinct successional stage" having specific characteristics. It defines the "classic" old growth stand as one that is physically imposing with tall, full-crowned trees; large standing dead material; fallen dead material; a dense canopy; and having moderated temperatures. According to Green *et al.* (1992, errata corrected 2005) old growth "…encompasses the later stages of stand development that typically differ from earlier stages in characteristics such as tree age, tree size, number of large trees per acre, and basal area. In addition, attributes such as decadence, dead trees, the number of canopy layers and canopy gaps are important but more difficult to describe because of high variability."

3.21.2.3.1 Existing Old Growth Stands

Existing conditions of old growth forest in the KNF portion of the analysis area are a result of historical timber harvest and wildfires (USDA Forest Service 2003b). Old growth stands occupying mesic sites in the analysis area are dominated by western hemlock and western redcedar. Common subdominant conifers at these sites include grand fir, Englemann spruce, Douglas-fir, and western larch. While western white pine is present at these sites, the majority occur as dead snags, having succumbed to disease. Lower elevation old growth stands are mainly composed of Douglas-fir, ponderosa pine, western larch, grand fir, or lodgepole pine. Upper elevation old growth sites support subalpine fir, western hemlock, western redcedar, grand fir, and Englemann spruce (Westech 2005d). Old growth forests in the Crazy and Silverfish PSUs are shown on Figure 84.

Old growth management area designations in the PSU were made to conserve the best old growth attributes available and to provide the best distribution, size, habitat type coverage, and quality possible. These old growth stands are physically connected to other old growth stands where possible, or are interconnected to adjacent old growth stands by stands composed of age classes more than 100 years old.

Table 143 summarizes the amount of old growth below 5,500 feet in elevation in the Crazy and Silverfish PSUs and the KNF. Table 143 also shows the amount of effective old growth, replacement old growth, effective or replacement old growth that has been given an MA designation or remains undesignated, and designated old growth required to meet KFP standards.

The Crazy PSU contains 55,925 total acres below 5,500 feet, including 47,982 acres of National Forest System lands, 6,702 acres of private lands, and 1,241 acres of state lands. Old growth stands on private and state lands have been mostly harvested, and the 9,097 acres of old growth (all categories) remaining on National Forest System lands below 5,500 feet is about 16 percent of all lands, and 19 percent of National Forest System lands below 5,500 feet in the Crazy PSU.

The Silverfish PSU contains 60,839 total acres below 5,500 feet, including 52,078 acres of National Forest System lands, 8,146 acres of private lands, and 615 acres of state lands. Old growth stands on private and state lands have been mostly harvested, and the 6,632 acres of old growth (all categories) remaining on National Forest System lands below 5,500 feet is about 11 percent of all lands, and 12.7 percent of National Forest System lands below 5,500 feet in the Silverfish PSU.

Currently, total designated effective old growth and replacement old growth occupies 16.8 and 12.9 percent of National Forest System lands below 5,500 feet in the Crazy and Silverfish PSUs, respectively (Table 143). Old growth in both PSUs currently meet KNF standards for maintaining at least 10 percent of the land base in old growth (per FSM 2432.22).

3.21.2.3.2 Attributes of Old Growth within the Landscape

As elements of dynamic landscapes, other attributes of old growth stands such as the size of old growth blocks, their juxtaposition and connectivity with other old growth stands, their topographic position, their shapes, their edge, and their stand structure compared to neighboring stands are important to evaluate. To maintain healthy and diverse ecosystems, the full range of natural variation should be represented and landscape mosaics should be managed as a whole (Green *et al.* 1992, errata corrected 2005). Management activities, such as timber harvest, road construction, or mining, have the potential to impact the function of old growth habitat or specific components of old growth, such as quantity of interior habitat, habitat patch sizes, and vertical structure.

Larger blocks (more than 50 acres) of old growth forest provide interior habitat and connectivity within National Forest System lands. Based on recommendations in Morrison *et al.* (1992), stands smaller than 50 acres were designated to protect additional attributes unique to old growth. Smaller patches of older, forested vegetation may be important stepping stones for dispersal of old growth-dependent wildlife species, especially in heavily fragmented landscapes. Although these patches may not meet criteria for interior conditions, their removal could prevent dispersal of some species across a larger landscape (Morrison *et al.* 1992). In the KNF, small patches of old growth habitat are largely surrounded by multi-aged stands, which also provide corridor links to larger blocks of old growth. Old growth block sizes in the Crazy and Silverfish PSUs are shown in Table 144.

Table 143. Old Growth Status in the KNF and the Crazy and Silverfish PSUs.

Old Growth Status	Crazy PSU Acres[1] (Percent[2])	Silverfish PSU Acres[1] (Percent[2])	KNF Acres[3] (Percent[2])
Total National Forest System lands	60,215	60,515	
Total National Forest System lands below 5,500 feet elevation	47,982	52,078	1,869,209
KFP minimum standard for old growth	4,798 (10.0)	5,208 (10.0)	186,921 (10.0)
***Designated old growth*[4]**			
Designated effective[5] old growth	7,801 (16.3)	5,296 (10.2)	136,157 (7.3)
Designated replacement[6] old growth	265 (0.6)	1,361 (2.6)	61,272 (3.3)
Designated unknown[7] (KFP)	0 (0)	63 (<1.0)	19,824 (1.1)
Total designated effective old growth and replacement old growth	8,066 (16.8)	6,720 (12.9)	217,253 (11.6)
Undesignated effective old growth and replacement old growth			
Undesignated effective old growth	819 (1.7)	0 (0.0)	63,534 (3.4)
Undesignated replacement old growth	212 (0.4)	10 (<1.0)	36,792 (2.0)
Totals for both designated and undesignated old growth and replacement old growth			
Total designated and undesignated effective old growth	8,620 (18.0)[8]	5,271 (10.1)[8]	199,109 (10.7)[8]
Total designated and undesignated replacement old growth	477 (<1.0)	1,361 (2.6)	98,064 (5.2)
All old growth below 5,500 feet	**9,097 (19.0)**	**6,632 (12.7)**	**297,173 (15.9)**

[1] Updated in 2007 for the Crazy PSU and in 2006 for the Silverfish PSU. Replacement old growth stands were designated to provide old growth in the future within the PSU.
[2] Percentage calculated based on total National Forest System lands below 5,500 feet elevation.
[3] Forest-wide acres as of September 2006.
[4] Designated old growth: old growth forest designated as an old growth MA, such as MA 13.
[5] Effective old growth: meets all the age and size class old growth requirements, contains typical old growth habitat components, and is large enough or of appropriate shape to allow species dependent on forest interiors to flourish.
[6] Replacement old growth: stands that do not have enough old growth characteristics to be considered old growth, but that are expected to become old growth in time.
[7] Designation unknown: old growth designated as MA 13 in the KFP that has not been surveyed.
[8] Effective old growth includes acres inventoried on the ground plus 60 percent of old growth determined by photo interpretation, plus 60 percent of designated unknown old growth, based on results of old growth surveys described in the KFP. Thus, total designated and undesignated effective old growth is not directly additive.

Table 144. Old Growth Block Sizes in the Crazy and Silverfish PSUs.

Old Growth Status	Number of Blocks	Size Range (acres)	Number of Blocks Over 50 Acres	Percent Blocks Over 50 Acres
Crazy PSU				
Designated				
Effective	35	10 - 1,773	21	60
Replacement	3	25 - 167	1	33
Total	38	10 - 1,773	22	58
Undesignated				
Effective	11	23 - 84	7	64
Replacement	3	15 - 45	0	0
Total	14	15 - 84	7	50
Total of All Old Growth	**52**	**10 - 1,773**	**29**	**56**
Silverfish PSU				
Designated				
Effective	39	10 - 459	27	69
Replacement	22	13 - 167	12	55
Total	61	10 - 459	39	64
Undesignated				
Effective	0	0	0	0
Replacement	0	0	0	0
Total	0	0	0	0
Total of All Old Growth	**61**	**10 - 459**	**39**	**64**

Source: GIS analysis by ERO Resources Corp. using KNF data.

All old growth in the Crazy PSU, including undesignated and designated effective and replacement old growth, comprises a total of 52 blocks ranging from 10 acres to 1,773 acres. About 56 percent of these blocks are greater than 50 acres. Although there is less old growth in the Silverfish PSU, it contains proportionately more old growth blocks over 50 acres than the Crazy PSU. All old growth in the Silverfish PSU consists of 61 blocks ranging from 10 acres to 459 acres, with about 64 percent of the old growth blocks greater than 50 acres.

3.21.2.3.3 Stand Structure

Old growth stand structure is described by Green *et al.* (1992, errata corrected 2005). In summary, Green identifies three structural stages that are useful in describing old growth: late seral single-story (*e.g.*, ponderosa pine, Douglas-fir, or lodgepole pine sites); late seral multi-story (*e.g.*, larch or western white pine sites); and near-climax (*e.g.*, cedar, grand fir, or subalpine fir sites). Old growth stands in the Crazy and Silverfish PSUs can be characterized as predominately multi-story or near-climax (Westech 2005d).

3.21.2.3.4 Disturbance

Many roads and trails in the Crazy and Silverfish PSUs either bisect or are adjacent to old growth stands. Roads facilitate pedestrian and motorized access to old growth forest habitats, resulting in increased disturbance to vegetation and wildlife. Roads also increase access for firewood cutters who may remove standing snags and down logs that are important components of old growth forests. Within existing designated old growth in the Crazy and Silverfish PSUs, 35 miles of local

roads comprise 10 miles of seasonally restricted roads, 7 miles of roads closed year-round, and 18 miles of roads open year-round.

Timber harvesting can affect adjacent old growth stands by altering six microclimatic factors: solar radiation, soil temperature, soil moisture, air temperature, relative humidity, and wind speed (Chen *et al.* 1995). Microclimatic changes lead to vegetative changes such as species richness, diversity, and composition, and vegetative structure (Russell and Jones 2001). Changes in vegetative conditions may, in turn, affect wildlife, resulting in changes in associated wildlife communities and influencing other factors such as predation and competition (Askins 2000) (see pileated woodpecker analysis in section 3.24, *Wildlife Resources*). Effects of timber harvesting extend varying distances into the uncut stands depending on a number of variables, such as aspect, slope, elevation, wind speed, and direction. The depth of influence is also related to time since harvest, with effects dissipating within 20 to 50 years, depending on the factor (Russell and Jones 2001; Ripple *et al.* 1991; Russell *et al.* 2000). In the Crazy and Silverfish PSUs, average tree growth in stands where regeneration has occurred result in tree heights (20 to 50 feet) and densities (fully stocked stands) that reduce the depth of influence from edge effects after 30 years. Table 145 shows the amount of old growth currently influenced by edge effects, including the number of existing harvested stands (stands less than 30 years old) adjacent to old growth stands. These stands create an edge influence on about 1,790 acres of old growth in the Crazy PSU and about 440 acres of old growth in the Silverfish PSU. While edge areas may result in changes in vegetation and wildlife use, the edge areas remain functional for some species as old growth. Old growth areas not impacted by edge effects provide interior habitat.

3.21.2.3.5 Existing Old Growth Stands on Private and State Lands

The majority of private or state-owned land within the analysis area has been harvested in the past 20 to 30 years (Figure 83) and is heavily roaded. Although most previously harvested areas have well-established conifer regeneration, as described in section 3.21.1, *Vegetation Communities*, these areas do not provide effective old growth habitat. Coniferous forest on private lands is primarily dominated by dry, ponderosa pine/Douglas-fir communities that do not have old growth characteristics. Old growth on private and state lands within the analysis area consists primarily of riparian old growth and occurs mainly in the Fisher River, West Fisher Creek, and Hunter Creek riparian corridors (Figure 84).

3.21.2.4 Environmental Consequences

The following section discusses the direct, indirect, and cumulative effects on old growth for each of the mine alternatives, transmission line alternatives, and combined mine-transmission line alternatives. The mine alternatives would have no effect on old growth in the Silverfish PSU. Impacts of the transmission line alternatives on old growth in the Silverfish PSU would be limited to edge effects to 2 acres of old growth and a loss of 2 acres of interior old growth for Alternative E. Impacts on old growth in the Crazy PSU from the mine and transmission line alternatives are summarized in Table 145 and Table 146.

Table 145. Summary of Impacts on Old Growth from the Mine Alternatives in the Crazy PSU.

Measurement Criteria	[1] No Mine/Existing Conditions	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative	[4] Agency Mitigated Little Cherry Creek Impoundment Area
Unmitigated Effects				
Vertical structure removed in designated OG (acres)[1]	0	157	175	25
Remaining designated OG in PSU (OG+ROG)	8,066	7.909	7,891	8,041
Percent of designated OG in PSU (OG+ROG)	16.8	16.5	16.4	16.8
Vertical structure removed in undesignated OG (acres)[2]	0	150	8	150
Total road length in feet adjacent or through designated OG or ROG	163,627 (0)	164,947 (1,320)	164,947 (1,320)	164,947 (1,320)
Number of existing or proposed harvest stands adjacent to OG	76	79	81	81
Edge influence in OG (acres)	1,790	1,915 (+125)	1,957 (+167)	1,917 (+127)
Interior habitat remaining in OG (acres)	5,918	5,475 (-443)	5,562 (-356)	5,609 (-309)
Mitigated Effects				
OG designated to mitigate OG physically lost (acres)[3]	0	0	366	350
OG designated to mitigate edge effects (acres)[4]	0	0	167	127
OG designated to mitigate for designated OG changed to MA 31 (acres)[4]	0	0	54	182
Total OG designated (acres)	0	0	587	659
Percent of designated OG in PSU after mitigation	16.8	16.5	17.7	18.1

(#) Change from existing conditions due to the alternative.
OG = Old growth.
ROG = Replacement Old Growth.
Old growth would not be affected in the Silverfish PSU.
[1] Includes effective and replacement old growth.
[2] Effective old growth only.
[3] Mitigation for physical loss of old growth would be at a 2:1 ratio.
[4] Mitigation for increased edge effects or reallocation of designated old growth (MA 13) to MA 31 (Mineral Development) would be at a 1:1 ratio. MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 146. Summary of Impacts on Old Growth from the Transmission Line Alternatives.

Measurement Criteria	Alternative A – No Transmission Line/ Existing Conditions	Alternative B – North Miller Creek	Alternative C – Modified North Miller Creek	Alternative D – Miller Creek	Alternative E – West Fisher Creek
Crazy PSU					
Unmitigated Effects					
Vertical structure removed in designated OG (acres)[1]	0	23	8	13	13
Remaining designated OG in PSU (OG+ROG) (acres)	8,066	8,043	8,058	8,053	8,053
Percent of designated OG in PSU (effective OG+ROG)	16.8	16.8	16.8	16.8	16.8
Vertical structure removed in undesignated OG (acres)[2]	0	0	0	0	0
Total road length in feet adjacent or through designated OG or ROG	163,627	167,482 (3,854)	163,838 (211)	164,155 (528)	164,155 (528)
Number of existing or proposed harvest stands adjacent to OG	76	80	78	80	81
Edge influence in OG (acres)	1,790	(+102)	(+23)	(+38)	(+38)
Interior habitat remaining in OG (acres)	5,918	(-127)	(-31)	(-52)	(-52)
Silverfish PSU					
Unmitigated Effects[3]					
Edge influence in OG (acres)	0	0	0	0	(+2)
Interior habitat remaining in OG (acres)	0	0	0	0	(-2)
Crazy and Silverfish PSUs					
Mitigated Effects					
OG designated to mitigate OG physically lost (acres)[4]	0	0	16	26	26
OG designated to mitigate edge effects (acres)[5]	0	0	23	38	38
Total OG designated (acres)	0	0	39	64	64
Percent of designated OG in PSU after mitigation	16.8	16.8	16.9	16.9	16.9
Private and State Lands					
Old growth removed (acres)	0	4	2	2	6

(#) Change from existing conditions due to the alternative. OG = old growth; ROG = Replacement Old Growth.
[1] Includes effective and replacement old growth.
[2] Effective old growth only.
[3] None of the transmission line alternatives would remove old growth or increase roads adjacent to old growth in the Silverfish PSU. Impacts to old growth in the Silverfish PSU would be limited to edge effects from Alternative E.
[4] Mitigation for physical loss of old growth would be at a 2:1 ratio.
[5] Mitigation for increased edge effects would be at a 1:1 ratio. Designated old growth (MA 13) within the 500-foot-wide transmission line corridor reallocated as MA 23 would be within the area accounted for by edge effects. MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*.
Source: GIS analysis by ERO Resources Corp. using KNF data.

3.21.2.4.1 Alternative 1— No Mine

Alternative 1 would have no direct effect on designated old growth or associated plant and wildlife species (also see pileated woodpecker discussion in section 3.24, *Wildlife Resources*). As shown in Table 145, the conditions for all seven measurement criteria would remain unchanged. All old growth areas would maintain their existing conditions and continue to provide habitat for those species that use the area over a long term. The most recent forest-wide old growth analysis concludes that at least 10 percent of the KNF below 5,500 feet elevation is designated for old growth management (USDA Forest Service 2007d). This alternative would not affect the current proportion of old growth (Table 145) at either the PSU or KNF scale.

3.21.2.4.2 Alternative 2 – MMC's Proposed Mine

Alternative 2 would have the greatest effect on old growth of the mine alternatives, affecting 157 acres of designated old growth and 150 acres of undesignated old growth for a total of 307 acres of old growth habitat affected in the Crazy PSU (Table 145). Old growth in the Silverfish PSU and in private or state land outside the Silverfish PSU would not be affected. Alternative 2 would result in edge effects to about 125 acres of old growth habitat and a loss of about 443 acres of interior old growth habitat. The majority of impacts to designated old growth would occur in the LAD Area 2 at the mouth of Ramsey and Poorman creeks. Trees would be selectively thinned in 200 acres of the LAD Areas where spray irrigation would occur. Although these irrigated areas would likely continue to provide suitable habitat for some old growth-associated species, old growth habitat connectivity could be reduced between the Ramsey Creek and Poorman Creek drainages for other species. All of the impacts to undesignated effective old growth would occur as a result of the Little Cherry Creek Impoundment construction, eliminating 130 acres of a 150-acre old growth block. Reducing the size of old growth blocks would diminish their capacity to support old growth-dependent plant and wildlife species. At the PSU scale, Alternative 2 would result in a 0.3 percent loss of old growth in the Crazy PSU. The percent of designated old growth in the Crazy and Silverfish PSUs would remain above the 10 percent minimum standard specified in the KFP.

Alternative 2 would include the construction of about 1,320 feet of new roads through designated old growth habitat. As a result, less than 1 acre of old growth habitat would be lost. These impacts are included in the impacts to designated and undesignated old growth shown in Table 145. Because new roads would not be open to the public and would be reclaimed at mine closure, they are not likely to reduce snag levels from firewood gathering. Use of new roads associated with mine activities would result in long-term increases in disturbance to vegetation and wildlife.

3.21.2.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would affect 175 acres of designated old growth and 8 acres of undesignated old growth, for a total of 183 acres of old growth habitat in the Crazy PSU. Old growth in the Silverfish PSU and in private or state land outside the Silverfish PSU would not be affected. Relative to other alternatives, Alternative 3 would result in the most edge effects (167 acres) to old growth habitat. Alternative 3 would result in a loss of about 356 acres of interior old growth habitat. The majority of impacts to designated old growth would occur as a result of impoundment construction or in LAD Area 2 at the mouth of Ramsey and Poorman creeks, reducing old growth habitat connectivity between these drainages. Reducing the size of old growth blocks would diminish their capacity to support old growth-dependent plant and wildlife species. At the PSU scale, Alternative 3 would result in a 0.4 percent loss of old growth in the Crazy PSU. The percent of designated old growth in the Crazy and Silverfish PSUs would remain

above the 10 percent minimum standard specified in the KFP. Impacts of new roads constructed for Alternative 3 would be the same as Alternative 2.

Alternative 3 would involve the reallocation of 54 acres of designated old growth (MA 13) to MA 31 (Mineral Development) that have not been accounted for in direct disturbance and indirect edge effects (Table 145). The reallocation of MAs is described in section 3.14, *Land Use*. Although the MA change would not result in disturbance to or physical loss of old growth, the change would reduce the percent of designated old growth in the PSU. The designation of 587 acres of additional old growth would mitigate this reduction (Table 145).

Alternative 3 would include mitigation described in section 2.5.7.3.2, *Key Habitats* for impacts to old growth, such as the designation of additional old growth shown in Table 145 on National Forest System lands. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics. Alternative 3 mitigation would increase the percent of designated old growth in the Crazy PSU to 17.7 percent. Losses and degradation of old growth habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels.

3.21.2.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would have the least effect on old growth habitat of the mine alternatives, affecting 25 acres of designated old growth and 150 acres of undesignated old growth, for a total of 175 acres of old growth habitat in the Crazy PSU. Old growth in the Silverfish PSU and in private or state land outside the Silverfish PSU would not be affected. At the PSU scale, Alternative 4 would result in a 0.4 percent loss of old growth in the Crazy PSU. Impacts of new roads constructed for Alternative 4 would be the same as those described for Alternative 2.

Similar to Alternative 2, Alternative 4 would result in edge effects to about 127 acres of old growth habitat. Relative to the other mine alternatives, the least amount of interior old growth habitat (309 acres) would be lost as a result of Alternative 4.

Alternative 4 would involve the reallocation of 182 acres of designated old growth (MA 13) to MA 31 (Mineral Development) that have not been accounted for in direct disturbance and indirect edge effects. Although the MA change would not result in disturbance to or physical loss of old growth, the change would reduce the percent of designated old growth in the PSU. The designation of 659 acres (Table 145) of additional old growth would mitigate this reduction.

Mitigation for impacts to old growth for Alternative 4 would be similar to Alternative 3, except that Alternative 4 mitigation would increase the percent of designated old growth in the Crazy PSU to 18.1 percent.

3.21.2.4.5 Alternative A – No Transmission Line

Alternative A would have no direct effect on designated old growth or associated plant and wildlife species (also see discussion in section 3.24.3.5, *Pileated Woodpecker*). The conditions for all seven measurement criteria (Table 146) would remain unchanged. All old growth areas would maintain their existing conditions, and continue to provide habitat for those species that use the area over a long term. The most recent forest-wide old growth analysis concludes that at least 10 percent of the KNF below 5,500 feet elevation is designated for old growth management. This

alternative would not affect the current proportion of old growth (Table 146) at either the PSU or KNF scale.

3.21.2.4.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Alternative B would have the greatest impact on old growth habitat of the transmission line alternatives, affecting 23 acres of designated old growth in the Crazy PSU (Table 146). No undesignated old growth would be affected by Alternative B. Old growth in the Silverfish PSU would not be affected by Alternative B. Alternative B would result in edge effects to about 102 acres of old growth habitat and a loss of about 127 acres of interior old growth habitat. Alternative B would remove about 4 acres of old growth habitat on private land along the Fisher River and a short portion of Miller Creek. Loss of old growth habitat and edge effect may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels.

The majority of impacts to old growth would occur in the Ramsey Creek corridor and at the confluence of Libby and Howard creeks, reducing old growth habitat connectivity in these drainages. Reducing the size of old growth blocks would diminish their capacity to support old growth-dependent plant and wildlife species. At the PSU scale, the loss of old growth would have negligible effects on the proportion of old growth in the Crazy PSU (Table 146). The percent of designated old growth in the Crazy and Silverfish PSUs would remain above the 10 percent minimum standard specified in the KFP.

Alternative B would include the construction of about 3,854 feet of new roads through designated old growth habitat. As a result, less than 3 acres of old growth habitat would be lost. These impacts are included in the impacts to designated and undesignated old growth shown in Table 146. Because new roads would not be open to the public, would undergo interim reclamation after construction, and would be bladed and recontoured to match existing topography at transmission line decommissioning, the roads are not likely to reduce snag levels from firewood gathering. Use of new roads associated with transmission line construction would result in short-term disturbance to vegetation and wildlife.

3.21.2.4.7 Alternative C – Modified North Miller Creek Transmission Line Alternative

Alternative C would have the least effect on old growth habitat of the transmission line alternatives, affecting 8 acres of designated old growth habitat in the Crazy PSU (Table 146). No undesignated old growth would be affected by Alternative C. Old growth in the Silverfish PSU would not be affected by Alternative C. Relative to other alternatives, Alternative C would result in the fewest edge effects (23 acres) to old growth habitat. Alternative C would result in a loss of about 51 acres of interior old growth habitat. Alternative C would remove about 2 acres of old growth habitat on private land where the transmission line would cross the Fisher River (Figure 84).

The majority of impacts to old growth would occur at the confluence of Libby and Howard creeks, reducing old growth habitat connectivity between these drainages. Reducing the size of old growth blocks would diminish their capacity to support old growth-dependent plant and wildlife species. At the PSU scale, the loss of old growth would have a negligible effect on the proportion of old growth composition in the Crazy PSU and would not measurably impact old growth characteristics and attributes in the Crazy PSU or the KNF. The percent of designated old

growth in the Crazy and Silverfish PSUs would remain above the 10 percent minimum standard specified in the KFP.

Alternative C would include the construction of about 211 feet of new roads through designated old growth habitat. As a result, less than 0.25 acre of old growth habitat would be lost. These impacts are included in the impacts to designated and undesignated old growth shown in Table 146. Because new roads would not be open to the public and would be placed into intermittent stored service after transmission line construction, they are not likely to reduce snag levels from firewood gathering. Use of new roads associated with transmission line construction would result in short-term increased disturbance to vegetation and wildlife.

Mitigation for impacts of Alternative C on National Forest System lands would include the designation of additional old growth shown in Table 146. Alternative C mitigation would increase the percent of designated old growth in the Crazy PSU to 16.9 percent. Loss of old growth habitat and edge effect may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels.

Impacts to old growth on non-National Forest System lands would be minimized through implementation of the Environmental Specifications (Appendix D) and Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*). Also, the use of monopoles in these areas, if incorporated into the Vegetation Removal and Disposition Plan, would require less clearing.

3.21.2.4.8 Alternative D – Miller Creek Transmission Line Alternative

Effects on old growth from Alternative D on National Forest System lands would be the same as Alternative C, except that Alternative D would result in slightly more direct impacts and edge effects to old growth. Alternative D would result in the loss of 13 acres of designated old growth habitat, edge effects to 38 acres of old growth habitat, and the loss of about 52 acres of interior old growth habitat in the Crazy PSU (Table 146). Old growth in the Silverfish PSU would not be affected by Alternative C. Reducing the size of old growth blocks would diminish their capacity to support old growth-dependent plant and wildlife species.

Alternative D would include the construction of about 528 feet of new roads through designated old growth habitat. As a result, less than 0.4 acre of old growth habitat would be lost. These impacts are included in the impacts to designated and undesignated old growth shown in Table 146. Because new roads would not be open to the public and would be placed into intermittent stored service after transmission line construction, the roads are not likely to reduce snag levels from firewood gathering. Use of new roads associated with transmission line construction would result in short-term increased disturbance to vegetation and wildlife.

Impacts of Alternative D to old growth on private lands, as well as mitigation of these impacts, would be the same as Alternative C. Mitigation for impacts to old growth from Alternative D on National Forest System lands would be similar to Alternative C, except that slightly more old growth would be designated.

3.21.2.4.9 Alternative E – West Fisher Creek Transmission Line Alternative

Effects on old growth from Alternative E on National Forest System lands would be the same as Alternative D, except that Alternative E would result in edge effects to 2 acres of old growth habitat and a loss of about 2 acres of interior old growth habitat in the Silverfish PSU. Alternative

E would directly impact about 6 acres of old growth habitat on private and state land where the transmission line would cross the Fisher River and parallel West Fisher Creek (Figure 84). Mitigation for these effects would be the same as Alternative C.

3.21.2.4.10 Combined Mine-Transmission Line Effects

Direct impacts of the mine alternatives in combination with the transmission line alternatives are shown in Table 147. Impacts of the combined mine and transmission line alternatives on old growth in the Silverfish PSU would be limited to edge effects to 2 acres of old growth and a loss of 2 acres of interior old growth for Alternatives 3E and 4E. Impacts to old growth from combined mine and transmission line alternatives before mitigation would be the greatest for MMC's proposed alternative (Alternative 2B). Direct impacts to old growth from the agencies' alternatives (Alternatives 3C, 3D, 3E, 4C, 4D, and 4E), including impacts on private and state land, would range from 185 acres to 202 acres. Agency-mitigated alternatives would include mitigation for impacts to old growth, such as the designation of additional old growth shown in Table 147 on National Forest System lands. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics. With mitigation, the agencies' combined alternatives would result in an increased proportion of designated old growth on National Forest System lands. For the agencies' alternatives, impacts to old growth on private land would be minimized through implementation of the Environmental Specifications and Vegetation Removal and Disposition Plan. The use of monopoles in these areas, if incorporated into the Vegetation Removal and Disposition Plan, would require less clearing. For all combined alternatives, losses and degradation of old growth habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels.

3.21.2.4.11 Cumulative Effects

Past actions, particularly timber harvest, road construction, and fire suppression activities, have altered the old growth ecosystems in the analysis area, resulting in reductions in early and late succession habitats; conditions favoring shade-tolerant, fire-intolerant species; loss of large snags and down wood; and increases in tree density and a shift to a largely mid-seral structural stage (USDA Forest Service 2003b). Firewood cutting would continue to occur where open roads provide access to old growth habitat, contributing to snag removal. Continuing development of private lands, including timber harvest, home construction, and land clearing would contribute to losses of old growth habitat in the analysis area, but would not affect the proportion of old growth on National Forest System lands. In addition, it is likely that limited amounts of old growth occur on private and state lands, based on past and current harvest practices. The No Action Alternatives (Alternative 1 and Alternative A) would not contribute to cumulative impacts on old growth.

Regeneration harvest included in the Miller-West Fisher Vegetation Management Project, which would occur in the Silverfish PSU, would not directly affect old growth. The Miller-West Fisher Vegetation Management Project would result in minor increased edge effects where regeneration harvest is proposed adjacent to old growth. Currently, total designated effective old growth and replacement old growth occupies 16.8 and 12.9 percent of National Forest System lands below 5,500 feet in the Crazy and Silverfish PSUs, respectively (Table 143), above the 10 percent minimum standard specified in the KFP. While the action alternatives, in combination with other

Table 147. Summary of Impacts on Old Growth from Combined Mine and Transmission Line Alternatives.

Measurement Criteria	[1] No Mine Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Area		
		TL-B	TL-C	TL-D	TL-E	TL-C	TL-D	TL-E
Crazy PSU								
Unmitigated Effects								
Vertical structure removed in designated OG (acres)[1]	0	175	183	188	188	33	38	38
Remaining designated OG in PSU (OG+ROG) (acres)	8,066	7,891	7,883	8,030	8,030	8,033	8,028	8,028
Percent of designated OG in PSU (OG plus ROG)	16.8	16.4	16.4	16.4	16.4	16.7	16.7	16.7
Vertical structure removed in undesignated OG (acres)[2]	0	150	8	8	8	150	150	150
Total road length (feet) adjacent or through designated OG or ROG	163,627 (0)	168,801 (5,174)	165,158 (1,531)	165,475 (1,848)	165,475 (1,848)	165,158 (1,531)	165,475 (1,848)	165,475 (1,848)
Number of existing or proposed harvest stands adjacent to OG	76	82 (6)	82 (10)	84 (8)	85 (9)	82 (6)	84 (10)	85 (8)
Edge influence in OG (acres)	1,790	(+227)	(+190)	(+205)	(+205)	(+150)	(+165)	(+165)
Interior habitat remaining in OG (acres)	5,918	(-570)	(-387)	(-408)	(-408)	(-340)	(-361)	(-361)
Silverfish PSU								
Unmitigated Effects[3]								
Edge influence in OG (acres)					(+2)			(+2)
Interior habitat remaining in OG (acres)					(-2)			(-2)
Crazy and Silverfish PSUs								
Mitigated Effects								
OG designated to mitigate OG physically lost (acres)[4]	N/A	0	382	392	392	366	376	376
OG designated to mitigate edge effects (acres)[5]	N/A	0	190	205	205	150	165	165
OG designated to mitigate for designated OG changed to MA 31 (acres)[5]	N/A	0	54	54	54	182	182	182
Total OG designated (acres)	N/A	0	626	651	651	698	723	723
Percent of designated OG in PSU (OG plus ROG)	N/A	16.4	17.7	17.7	17.7	18.2	18.2	18.2
Private and State Lands								
Old growth removed (acres)	0	4	2	2	6	2	2	6

(#) number in parentheses is the change due to the alternative. OG = Old growth ROG = Replacement Old Growth; N/A = Not Applicable TL = Transmission Line Alternative.
[1]Includes effective and replacement old growth. Acreage may not equal that shown in Table 145 and Table 146 because of overlapping effects.
[2]Effective old growth only.
[3]None of the transmission line alternatives would remove old growth or increase roads adjacent to old growth in the Silverfish PSU. Impacts to old growth in the Silverfish PSU would be limited to edge effects from Alternative E.
[4]Mitigation for physical loss of old growth would be at a 2:1 ratio.
[5]Mitigation for increased edge effects or reallocation of designated old growth (MA 13) to MA 31 (Mineral Development) would be at a 1:1 ratio.
Source: GIS analysis by ERO Resources Corp. using KNF data.

past, current, and reasonably foreseeable actions, would result in some losses and degradation of old growth habitat, cumulative impacts on levels of old growth would likely be minimal. In addition, mitigation associated with the agencies' Alternatives 3, 4, C, D, and E would increase the proportion of designated old growth and promote the maintenance or development of old growth in the analysis area.

3.21.2.4.12 Regulatory/Forest Plan Consistency

All action alternatives would require a project-specific amendment to allow harvest within designated old growth stands (MA 13). The project-specific amendment would change the current MA 13 (Designated Old Growth) designation of all harvested stands to either MA 23 (Electric Transmission Corridor) or 31 (Mineral Development). All action alternatives would be consistent with KFP direction to maintain a minimum of 10 percent old growth below 5,500 feet in elevation in each 3rd-order drainage or compartment, or a combination of compartments.

Analysis of old growth Forest-wide (USDA Forest Service 2007d) concludes that at least 10 percent of the KNF below 5,500 feet is managed as old growth, as required in the KFP. Specifically, National Forest System lands below 5,500 feet include 297,173 acres (15.9 percent) of old growth or replacement old growth (Table 143). About 10.7 percent (199,109 acres) of those lands were determined to be effective old growth, and 5.2 percent (98,064 acres) were identified as replacement old growth.

The action alternatives would result in between 16.4 and 18.2 percent designated old growth below 5,500 feet elevation in the Crazy PSU, and 12.9 percent designated old growth below 5,500 feet elevation in the Silverfish PSU. The KFP established that maintaining 10 percent of old growth habitat is sufficient to support viable populations of old-growth dependent species (KFP, Vol. 1, II-1, 7, III-54; Vol. 2, A17).

Other applicable standards established in the KFP for MA 13 (Designated Old Growth) include:

- Recreation: All action alternatives would comply with these standards. A forest closure order exists to off-highway vehicles, which restricts the off-highway vehicles to established roads and trails.
- Wildlife and Fish: All action alternatives would comply with these standards. Activities that potentially conflict with grizzlies in Management Situation 1 and 2 grizzly habitat are described in section 3.24, *Wildlife Resources*.
- Soil, Water, and Air: All alternatives would comply with these standards. As described in sections 3.18, *Soils and Reclamation* and 3.4, *Air Quality*, all action alternatives would be in compliance with soil standards in the KFP and MAAQS. For all action alternatives, BMPs would be implemented to reduce erosion and sedimentation.
- Riparian: Compliance with INFS standards have been discussed in section 3.6, *Aquatic Life and Fisheries*.
- Timber: Firewood cutting could impact snags located in old growth habitat, and this effect is taken into consideration in the cavity habitat analysis in section 3.24, *Wildlife Resources*. Timber harvest would occur, as shown in Table 145 and Table 146. All action alternatives require a project-specific amendment to allow harvest within designated old growth stands (MA 13). The project-specific amendment to change the current MA 13

(Designated Old Growth) designation of all harvested stands to either MA 23 (Electric Transmission Corridor) or 31 (Mineral Development).

- Facilities: All action alternatives would comply with these standards. Some areas of MA 13 would be reallocated to MA 31 (Mineral Development) or MA 23 (Electric Transmission Corridor) for each action alternative. For all action alternatives, some currently closed or restricted roads would be open to mine traffic, but would not be accessible to the public (see Table 9 for Alternative 2, Table 17 for Alternative 3, Table 30 for Alternative 4). All action alternatives would continue to restrict motorized access on other local roads where closures exist.

3.21.2.4.13 Irreversible and Irretrievable Commitments

All action alternatives would result in an irreversible commitment of old growth forest in the Crazy PSU and in small areas of private land along the transmission line corridor near U.S. 2. No direct effects on old growth habitat would occur in the Silverfish PSU. Irretrievable commitments of old growth resources in the Silverfish PSU would occur due to indirect impacts from minor edge effects resulting from Alternative E. The recovery time of old growth forest would preclude restoration for centuries following disturbance.

3.21.2.4.14 Short-term Uses and Long-term Productivity

Losses of old growth habitat resulting from implementation of the action alternatives would be long-term, and would be limited to the Crazy PSU and small areas of private land along the transmission line corridor near U.S. 2. Alternative E would result in minor edge effects, which would continue beyond the reclamation phase. If reclamation were successful and successional processes were allowed to take place, edge effects would eventually dissipate. Given the recovery time of old growth forest, edge effects would likely require centuries following disturbance to be eliminated.

3.21.2.4.15 Unavoidable Adverse Environmental Effects

Unavoidable adverse effects would occur from all action alternatives in the Crazy PSU and small areas of private land along the transmission line corridor near U.S. 2 where old growth habitat would be directly removed. Edge effects from Alternative E also would be an unavoidable adverse effect to old growth habitat.

3.21.3 Threatened, Endangered, and Sensitive Plant Species

The KNF monitors plant species considered to be of concern. Plant species of concern are characterized as threatened, endangered, sensitive, or Category 4 watch species. T&E species include species listed by the USFWS and protected under the ESA. Forest sensitive species are those species the Regional Forester determines to be a concern on National Forest System lands in the Region due to declining numbers. The KNF works closely with the Montana Natural Heritage Program (MNHP), which maintains records of plant species of concern. State listed plant species of concern are also discussed in the following sections.

3.21.3.1 Regulatory Framework

Section 3.6, *Aquatic Life and Fisheries* discusses the regulatory framework for federally listed threatened or endangered plant species, and Forest sensitive plant species. One Forest sensitive and state listed plant species of concern was found in the analysis area, the northern beechfern

(*Thelypteris phegopteris*). The KFP requires the maintenance of diverse age classes of vegetation for viable populations of all existing native, vertebrate wildlife species.

There are no regulatory requirements to protect Forest sensitive or state plant species of concern on private land. The DEQ strives to work with proponents of mine development to voluntarily limit impacts to Forest sensitive or state plant species of concern. The MFSA directs the DEQ to approve a facility if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impacts, considering the state of available technology and the nature and economics of the various alternatives.

3.21.3.2 Analysis Area and Methods

The analysis area consists of all areas that would be disturbed by facility construction under any alternative (Figure 83). Potential habitat for sensitive plants was surveyed in areas surrounding facilities as proposed in 1989. Sensitive plant surveys followed KNF guidelines and procedures and were conducted during the summers of 1988 and 1989 (Western Resource Development 1989d, 1989e), with additional updates in the summer of 2005 (Westech 2005c). During the sensitive plant survey, habitats for sensitive plants were thoroughly examined and the remainder of the analysis area was less thoroughly examined (Westech 2005c). Additional sensitive plant inventories of the Poorman Tailings Impoundment Site, the Libby Plant Site, and the Upper Libby Adit Site were conducted in June and August of 2007 (Geomatrix 2007e). Surveys for sensitive plants were not completed for Alternative E - West Fisher Creek Alternative, a segment of Alternative D - Miller Creek Alternative in upper Miller Creek, segments of Alternative C – Modified North Miller Creek Alternative where they differ from Alternative B, and the segment in Alternatives C, D, and E from the Sedlak Park Substation north to where the alignment crosses Alternative B.

Information from these surveys was used to determine effects on plant species of concern. MNHP records are used in this summary to describe the characteristics of plant species of concern found during surveys of the analysis area. No surveys specifically for Category 4 watch species were conducted in the analysis area. Category 4 watch species were identified and recorded during surveys and are included in vascular plant species lists identified in the analysis area (Westech 2005c) and are not discussed further.

3.21.3.3 Affected Environment

Two federally listed threatened plant species and one candidate species were identified to potentially occur in the analysis area: water howellia (*Howellia aquatilis*), Spalding's campion (*Silene spaldingii*), and linearleaf moonwort (*Botrychium lineare*). Suitable habitat for federally listed or candidate species was evaluated and determined to be limited in the analysis area (Westech 2005c). No federally listed T&E plant species have been found in the analysis area and T&E plant species are not discussed further.

One Forest sensitive and state listed plant species of concern was found in the 2005 inventory, the northern beechfern (*Thelypteris phegopteris*). Northern beechfern is found at 18 locations in scattered populations in the northwestern Montana in Flathead, Glacier, Lincoln, and Sanders counties (MNHP 2008). Three of the 18 occurrences are on the Libby Ranger District of the KNF (MNHP 2006a). Northern beechfern is found in populations (ranging from 10 to 100 individuals) on benches above Little Cherry Creek in the analysis area (Westech 2005c). The northern beechfern is a sensitive species due to a combination of rarity, limited distribution within the

Northern Region, and potential habitat loss (MNHP 2006a). The MNHP has classified the northern beechfern as secure globally, but imperiled in Montana because of rarity within the state. Habitat characteristics for the northern beechfern include old growth and mature western red cedar and western hemlock, which occur in the coniferous forest community. Understory plants found with northern beechfern are queencup beadlily, devil's club and lady fern. Management goals for northern beechfern population and genetic viability associated with each are discussed in the KNF Conservation Assessment Report prepared as a result of the 1992 EIS completed for the Montanore Project (KNF 1993).

3.21.3.4 Environmental Consequences

3.21.3.4.1 Alternative 1 – No Mine

The No Mine Alternative would not affect any Forest sensitive or other state listed plant species of concern.

3.21.3.4.2 Alternative 2 – MMC's Proposed Mine

Under Alternative 2, one Forest sensitive and state listed plant species of concern plant population would be affected, the northern beechfern. The northern beechfern population is located in a long slender band along the Little Cherry Creek Tailings Impoundment Site adjacent to Little Cherry Creek. The population would be eliminated during impoundment construction.

3.21.3.4.3 Alternative 3 – Agency-Mitigated Poorman Impoundment Alternative

Alternative 3 would not affect any Forest sensitive and state listed plant species of concern.

3.21.3.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

The effect on Forest sensitive and state listed plant species of concern for Alternative 4 would be the same as Alternative 2.

3.21.3.4.5 Alternative A – No Transmission Line

In Alternative A, the transmission line and substation for the Montanore Project would not be built. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

3.21.3.4.6 Alternatives B, C, D, and E

No Forest sensitive or other state listed plant species of concern were identified along the transmission line corridors surveyed. Surveys for Forest sensitive and state listed plant species of concern were not conducted for portions of Alternative C –Modified North Miller Creek that differ from Alternative B, the west spur of Alternative D – Miller Creek, Alternative E – West Fisher Creek, and the southern spur to Sedlak Park Substation. Prior to final design and any ground-disturbing activities, MMC would complete a survey for threatened, endangered, or Forest sensitive plant species on National Forest System lands for any areas where such surveys have not been completed that would be disturbed by the alternative. Similarly, MMC would conduct surveys for threatened, endangered, and state-listed plant species potentially occurring on non-National Forest System lands. Results of the surveys would be submitted to the agencies for review and comment. If adverse effects could not be avoided, MMC would develop appropriate

mitigation plans for the agencies' approval. The mitigation would be implemented before any ground-disturbing activities. To the extent feasible, MMC would make adjustments to structure and road locations, and other disturbing activities to reduce impacts.

3.21.3.4.7 Cumulative Effects

No other reasonably foreseeable projects in the region, including the Miller-West Fisher Vegetation Management Project, would directly impact federally listed, Forest sensitive, or state listed plant species of concern.

3.21.3.4.8 Regulatory/Forest Plan Consistency

No federally listed plant species were found in the analysis area. None of the alternatives would likely cause a trend to federal listing or loss of species viability of the northern beechfern. All alternatives would be in compliance with the KFP.

3.21.3.4.9 Irreversible and Irretrievable Commitments

An irretrievable commitment of resources would occur for all mine action alternatives from the loss of one population of Forest sensitive and state listed plant species of concern. Reclamation of habitat upon completion of mining may provide conditions suitable for establishment of affected species. Increases in populations of introduced species after disturbance may limit the potential for re-establishment of these species.

3.21.3.4.10 Short-term Uses and Long-term Productivity

Mine operations would result in both a short-term and long-term loss of one population of Forest sensitive and state listed plant species of concern under all action alternatives. Reclamation of habitat following mining may provide habitat for affected species. Increases in populations of introduced species after disturbance may limit the potential for re-establishment of these species.

3.21.3.4.11 Unavoidable Adverse Environmental Effects

Long-term loss of one small populations of Forest sensitive and state listed plant species of concern would occur for all mine action alternatives. None of the transmission line alternatives would affect sensitive plant populations.

3.21.4 Noxious Weeds

3.21.4.1 Regulatory Framework

Noxious weeds are defined by the Forest Service as "those plant species designated as noxious weeds by the Secretary of Agriculture or by the responsible state official. Noxious weeds generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease and being not native, or new to, or not common to the United States or parts thereof" (USDA Forest Service 2001).

The Montana County Weed Control Act (MCA 7-22-2101 *et seq.*) defines noxious weeds as "any exotic plant species established or that may be introduced in the state which may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses or that may harm native plant communities and that is designated a state noxious weed by rule of the Department of Agriculture; or a noxious weed by a county board." It also states that it is unlawful for any person to permit any noxious weed to propagate or go to seed on his land. The KNF has signed a memorandum with Lincoln County and has agreed to assist and cooperate with the Lincoln

County Weed District in managing noxious weeds. The Forest Service's guidelines for controlling noxious weeds are provided in the FSM 2080 Noxious Weed Management Handbook (USDA Forest Service 2001) and Appendix A of the KNF Invasive Plant Management Final EIS (KNF 2007a). The Lincoln County Weed District has identified several species of noxious weeds that occur or potentially occur in Lincoln County (Lincoln County 2004).

3.21.4.2 Analysis Area and Methods

The analysis area for noxious weeds includes all the mine-related facilities, roads, and transmission line alignments that would potentially be disturbed by mine and transmission line construction and operations (Figure 83).

Noxious weed baseline surveys for the Montanore Project facilities as proposed in 1989 were conducted during the summers of 1988 and 1989 (Western Resource Development 1989d, 1989e). Noxious weed surveys were updated in 2005 to determine if the weed species or distribution had changed (Westech 2005b). Most proposed mine facility locations and transmission line alternatives were surveyed for noxious weeds. The following areas were not surveyed: the majority of the Poorman Impoundment Site (Alternative 3), the Libby Plant Site (Alternatives 3 and 4), the Upper Libby Adit Site (Alternatives 3 and 4) and West Fisher Creek (Alternative E). Areas not evaluated for noxious weeds are believed to have similar noxious weed infestations and would require similar control methods.

The potential for noxious weed introduction and establishment for the alternatives evaluated was determined based on existing weed populations, total amount of disturbance, and plans to control weeds and revegetate disturbed areas.

3.21.4.3 Affected Environment

Noxious weeds are categorized by the state, county, and Forest Service for management and control. Lincoln County categorizes noxious weeds in Categories I through IIIa (Lincoln County 2004). Lincoln County Category I species are weeds that cover large areas, but are not targeted for weed control. Lincoln County Category II species are both widespread and targeted for weed control management (Westech 2005b). Lincoln County Category IIIa species are potential invaders. They include noxious weeds that do not currently exist in Lincoln County but have a high probability of causing severe environmental or economic degradation. The State of Montana and KNF noxious weed plans (KNF Noxious Weed Handbook, Spring 2008, Edition 5.0) categorize noxious weeds into similar groups as Lincoln County, but different priorities. Noxious weed categories are listed in Table 148.

KNF Category 1 and 2, State Category 1 and 2, and Lincoln County Category I, II, and IIIa species were observed in several locations in the analysis area. Nine species of noxious weeds were found in the analysis area during the 2005 baseline vegetation studies: Canada thistle; spotted knapweed; ox-eye daisy; orange hawkweed; meadow hawkweed; St. Johnswort; sulfur cinquefoil; tall buttercup; and common tansy (Westech 2005b). The 1988 vegetation baseline inventory (Western Resource Development 1989d, 1989e) documented three listed noxious weeds in the analysis area as well as three noxious weeds yet to be officially listed: Canada thistle, spotted knapweed, St. Johnswort, orange hawkweed, ox-eye daisy, and tall buttercup. Meadow hawkweed, sulfur cinquefoil, and common tansy were not recorded in the initial mine analysis area in 1988, but were recorded in 2005.

Table 148. Noxious Weeds Found in the Analysis Area.

Weed Species	Scientific Name[†]	State Category	Lincoln County Weed Category	KNF Weed Category
Canada thistle	*Cirsium arvense*	1	II	1
Common tansy	*Tanacetum vulgare*	1	II	1
Meadow hawkweed	*Hieracium caespitosum*	2	I	1
Orange hawkweed	*Hieracium aurantiacum*	2	I	1
Ox-eye daisy	*Leucanthemum vulgare*	1	I	1
Spotted knapweed	*Centaurea stoebe*	1	I	1
St. Johnswort	*Hypericum perforatum*	1	I	1
Sulphur cinquefoil	*Potentilla recta*	1	I	1
Tall buttercup	*Ranunculus acris*	2	IIIa	2

[†]Scientific name from USDA NRCS 2008.

Canada thistle is a deep-rooted, creeping perennial that is native to Eurasia. In the analysis area, Canada thistle is common in disturbed swales, mesic areas, and in wetlands where logging has occurred. Monocultures characterized by a high density of Canada thistle are present as scattered plants with low concentrations (Westech 2005b).

Common tansy is a perennial forb that is poisonous if ingested. It is not as dominant as the other listed noxious weeds in the analysis area. This species is found most frequently along roads and in disturbed areas, and along riparian corridors. It is common in patches along the Fisher River (Westech 2005b).

Meadow hawkweed has almost identical vegetative growth characteristics to orange hawkweed and is difficult to distinguish without flowering heads. Meadow hawkweed is less common in the analysis area than orange hawkweed, and is found primarily along roads (Westech 2005b).

Orange hawkweed is a perennial with a fibrous, creeping root system. It has clusters of orange dandelion-like heads and is the most abundant and problematic noxious weed in the Montanore analysis area. It is found mostly in logged and disturbed areas in western hemlock/western red cedar forest types. Most roadsides are dominated by orange hawkweed (Westech 2005b).

Once a cultivated species, ox-eye daisy is an invasive weed that is becoming an increasing problem in the western states. Ox-eye daisy is most common along roads and in recently logged areas in the Montanore analysis area (Westech 2005b). It is invading many meadows in northwestern Montana.

Spotted knapweed is an aggressive invader that generally occurs in disturbed areas. Spotted knapweed is a perennial, taprooted Eurasian weed species that invades range and harvested forestland throughout the West. It can reduce biodiversity, wildlife and livestock forage production, and can also increase soil erosion (Montana Summit Steering Committee 2005). Spotted knapweed grows best in well-drained soils. Spotted knapweed occurs throughout the analysis area, particularly along roads, on disturbed areas, and in areas where timber has been harvested and tree canopy cover is relatively open. Undisturbed areas typically do not have large infestations of spotted knapweed (Westech 2005b).

St. Johnswort is a perennial species that was introduced because of its medicinal properties. Montana's Department of Agriculture reports that St. Johnswort covers an area of about 500,000 acres in Montana (Montana Summit Steering Committee 2005). This plant is unpalatable and mildly poisonous to livestock. It is observed along roads and in recent previously harvested coniferous forests but coverage was spotty or minor (Westech 2005b).

Sulfur cinquefoil is a perennial species with well-developed creeping woody roots. Sulfur cinquefoil was recorded in Sedlak Park and along U.S. 2 near the analysis area (Westech 2005b).

Tall buttercup is a perennial species that grows up to 3 feet tall and is poisonous to livestock if ingested. Tall buttercup was present in the 1988 baseline vegetation inventory but was not located during the 2005 baseline vegetation survey (Westech 2005b).

3.21.4.4 Environmental Consequences

3.21.4.4.1 Alternative 1 – No Mine

Introduced species and noxious weeds have increased in the analysis area between the time the baseline vegetation surveys were conducted in 1988 and 1989 and the time they were updated in 2005. This would continue in the future with or without the mine. The No Mine Alternative would not involve land-disturbing activities likely to increase the number and distribution of noxious weeds. Noxious weeds currently present in the analysis area would continue to be subject to existing Forest Service, state, and countywide weed management practices. Noxious weeds at the Libby Adit Site would continue to be controlled in accordance with existing permits and approvals. The Forest Service and other land mangers and owners are not required to control other introduced species.

3.21.4.4.2 Alternative 2 – MMC's Proposed Mine

Alternative 2 would increase the spread and establishment of noxious weeds and other introduced species associated with ground-disturbing activities. Weeds invade disturbed ground where they easily establish and out-compete native species even with a weed control program. Weed establishment would more likely occur along roads, cut and fill slopes, the margins of mine facilities, soil stockpiles, and other disturbed areas. The distribution of noxious weeds and other introduced species would probably be greatest under Alternative 2 because it includes the largest area of potential disturbance (2,581 acres).

MMC's weed control program would minimize weed infestations on lands disturbed by the proposed facilities. All off-highway vehicles and earth moving equipment entering Lincoln County would be washed at a commercial facility. Special emphasis would be taken to remove soil and other plant material from the vehicle or equipment. MMC would notify KNF at least 24 hours in advance of equipment delivering to the site to provide an opportunity to inspect the equipment. Weed control during operations would primarily be through the use of herbicides. Additionally, a 3-year continuous monitoring and treatment program would be implemented (MMI 2006). Criteria in the reclamation plan for Alternative 2 require that vegetation composition would have less than 10 percent cover of noxious weeds. MMC would not be required to control other introduced species.

3.21.4.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

With 2,011 acres of disturbance, Alternative 3 would have similar potential to increase the infestation and spread of noxious weeds and other introduced species as Alternative 2, although

distribution would likely be less. All weed BMPs discussed in section 2.5.5.2.5, *Noxious Weed Mitigation Measures* for Alternative 3 would be implemented, and would reduce the establishment and spread of noxious weeds, compared to Alternative 2. Weed BMPs would address the treatment and control of noxious weeds throughout all mine facilities.

The reclamation plan for Alternative 3 differs from Alternative 2 and would require that noxious weeds would have less than 10 percent cover of species listed as Category 1 (established infestations) and 0 percent cover of Category 2, and 3 (potential invaders and new invaders, as described in the KNF Noxious Weed Handbook, Spring 2008, Edition 5.0) in reclaimed areas. Category 1 noxious weeds would not dominate any location greater than 400 square feet. The goal of Alternative 3 would be to use a native seed mix, if commercially available, that would reduce the spread of invasive or noxious species. In Alternative 3, shrubs and trees would be planted by hand in random patterns to prevent the spread or infestation of noxious weeds by limiting disturbance from machinery. MMC would not be required to control other introduced species.

3.21.4.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would have the same potential to result in the establishment and spread noxious weeds and other introduced species as described for Alternatives 2 and 3. The reclamation and weed management plans for Alternative 4 would be the same as Alternative 3. MMC would not be required to control other introduced species.

3.21.4.4.5 Alternative A – No Transmission Line

In Alternative A, the transmission line and substation for the Montanore Project would not be built. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

3.21.4.4.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Alternative B would have the largest area of surface disturbance associated with new or upgraded road construction and timber clearing of the four alternatives (Table 142). New roads would be reseeded as an interim measure, but would continue to be used for maintenance activities, as necessary. Surface disturbances and continued road use would increase the risk of noxious weed and other introduced species spread and would require more monitoring and control of noxious weeds. Alternative B would have the least area of vegetation clearing, which would minimize disturbance and associated weed spreading that would be the result of clearing. MMC's weed control program described in Alternative 2 would be implemented for Alternative B, and is designed to minimize weed infestations on lands disturbed by the proposed facilities. Vehicles would be cleaned before entering the area and following work in weed infested areas. BPA's plan to conduct a noxious weed survey at the proposed Sedlak Park Substation Site before and after construction of the substation and its weed control program would minimize noxious weeds at the site. MMC and the BPA would not be required to control other introduced species.

3.21.4.4.7 Effects Common to Transmission Line Alternatives C, D, and E

These alternatives would use a helicopter to construct between 20 and 23 structures, which would minimize new road construction or reconstruction. A helicopter would be used to clear timber in areas adjacent to core grizzly bear habitat. Roads placed in intermittent stored service or decommissioned would not be used for routine maintenance of the transmission line, but could be used for emergency repairs, such as a damaged insulator. These modifications would reduce the risk of noxious weed spread. Because these alternatives would require greater vegetation clearing along the transmission line corridor, weed spread associated with such clearing would be greater in these alternatives than Alternative B. MMC's weed control program described in Alternative 2 and modified in Alternative 3 would minimize weed infestations on lands disturbed by the transmission line facilities. BPA's plan to conduct a noxious weed survey at the proposed Sedlak Park Substation Site before and after construction of the substation and its weed control program would minimize noxious weeds at the site. MMC would coordinate with the Forest Service Weed Specialist for use of biocontrol agents as they become available. MMC and BPA would not be required to control other introduced species.

3.21.4.4.8 Cumulative Effects

Past actions, particularly timber harvest, road construction and fire suppression, coupled with human activity have resulted in the establishment of the existing noxious weed and other introduced species populations in the analysis area. All reasonably foreseeable future projects in the area that involve ground disturbances have the potential to spread and increase the number of noxious weeds and other introduced species. Any ground-disturbing activities, activities that involve large equipment, livestock grazing, or activities that increase motor access could increase spread of noxious weeds or introduce new invaders to the area. Noxious weed and other introduced species infestations would impact sensitive plant species. The construction of both the Montanore Project and the Rock Creek Project would increase the opportunity for noxious weeds to invade the CMW from the east and west. All reasonably foreseeable actions would be subject to existing Forest Service, state, and county wide management practices, which have proven effective in slowing the spread of noxious weeds. The Forest Service and other land mangers and owners are not required to control other introduced species.

3.21.4.4.9 Regulatory/Forest Plan Consistency

All mine and transmission line alternatives would follow KNF BMPs and be in compliance with the Montana County Weed Control Act. All alternatives would be consistent with the KFP regarding noxious weed management.

3.21.4.4.10 Irreversible and Irretrievable Commitments

All alternatives would increase noxious weed and other introduced species populations, which would displace native species, and result in an irreversible loss of plant species.

3.21.4.4.11 Short-term Uses and Long-term Productivity

All alternatives would increase noxious weed and other introduced species populations, which would displace native species, and reduce their long-term productivity.

3.21.4.4.12 Unavoidable Adverse Environmental Effects

An unavoidable increase in weed and other introduced species populations would occur under all alternatives. Invasion of noxious weeds and other introduced species as well as spraying of noxious weeds with chemicals would result in the loss of some native plant species.

3.22 Wetlands and Other Waters of the U.S.

3.22.1 Regulatory Framework

Waters of the U.S. are defined broadly in the Corps' regulations to include a wide variety of waters and wetlands. The Corps defines "wetlands" as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (33 CFR 328.3 (b)). Under natural conditions, waters of the U.S. provide food and habitat for fish and wildlife, flood protection, erosion control, water quality improvement, and opportunities for recreation (Adamus et. al 1991). The term "wetlands and other wetland waters of the U.S." includes both deep-water habitats (non-wetland) and special aquatic sites, which include wetlands (Environmental Laboratory 1987).

This section discusses wetlands and other waters of the U.S. found within the analysis area. In Montana, surface water is any water of the State at the surface of the ground, including but not limited to any river, stream, creek, ravine, coulee, undeveloped spring, lake, and other natural surface source of water regardless of its character or manner of occurrence (ARM 36.12.101). The Corps determines a water to be subject to its jurisdiction if the water body is a traditionally navigable water, relatively permanent, or a wetland that directly abuts a traditionally navigable or relatively permanent water body, or, in combination with all wetlands adjacent to that water body, has a significant nexus with traditionally navigable waters. (Corps and EPA 2007).

Federal agencies have the responsibility to avoid, minimize, and mitigate unavoidable effects to wetlands and waters of the U.S. under Section 404(b)(1) of the Clean Water Act and Executive Order 11990—Protection of Wetlands. All waters of the U.S. as well as activities that result in the discharge of fill material into wetlands or waters of the U.S. are regulated by the Corps. Based on a Supreme Court 2001 ruling, wetlands that are isolated from other waters of the U.S., and whose only connection to interstate commerce is use by migratory birds, do not fall under Corps' jurisdiction. The terms "isolated" and "non-jurisdictional" wetlands are used synonymously.

Projects subject to the Corps' jurisdiction also must comply with the 404(b)(1) Guidelines for discharge of dredged and fill material into wetlands and waters of the U.S. (40 CFR 230). It is anticipated that one or more Montanore Project facilities would need a 404 permit from the Corps. The 404(b)(1) Guidelines specify "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse affect on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." An alternative is considered practicable if "it is capable of being done after taking into consideration cost, existing technology, and logistics in the light of overall project purposes." Practicable alternatives under the Guidelines assume that "alternatives that do not involve special aquatic sites are available, unless clearly demonstrated otherwise." The Guidelines also assume that "all practicable alternatives to the proposed discharge which do not involve a discharge into a special aquatic site are presumed to have less adverse affect on the aquatic ecosystem, unless clearly demonstrated otherwise" (40 CFR 230).

The KNF established standards for wetlands under the INFS standards (USDA Forest Service 1995). INFS standards and guidelines apply to an area within 150 feet of a wetland greater than 1

acre in size. For a wetland less than 1 acre, INFS standards and guidelines apply to an area within 100 feet of a wetland in priority watersheds, and within 50 feet of a wetland in non-priority watersheds.

3.22.2 Analysis Area and Methods

The analysis areas are areas where potential direct or indirect effects to wetlands and waters of the U.S. by any of the alternatives would occur. As part of a baseline inventory, MMC identified and delineated wetlands and other waters of the U.S. within the proposed permit area boundaries and along the transmission line corridors then under consideration (Westech 2005e). Wetland delineations for alternative sites for the Poorman Tailings Impoundment Site (Alternative 3), Libby Plant Site, and Upper Libby Adit (Alternatives 3 and 4) also were conducted (Geomatrix 2007e). Wetland delineations were not completed for Alternative E - West Fisher Creek Alternative, a segment of Alternative D - Miller Creek Alternative in upper Miller Creek, segments of Alternative C – Modified North Miller Creek Alternative where they differ from Alternative B, and the segment in Alternatives C, D, and E from the Sedlak Park Substation north to where the alignment crosses Alternative B. Wetland delineations also would be needed at sites proposed in the agencies' fisheries and wildlife mitigation measures, such as road crossings where culverts would be removed.

Using methods outlined in the 1987 Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987), MMC determined wetlands based on the presence of three wetland indicators: hydrophytic vegetation, hydric soils, and wetland hydrology. Wetland boundaries were flagged and delineated using a Global Positioning System (GPS) device. Waters of the U.S. not likely to be filled with dredged or fill material, or sites where GPS coverage was lacking, were delineated from aerial photo interpretation. This included wetlands along access roads and the powerline corridor, and on private lands.

MMC also delineated "isolated" or non-jurisdictional wetlands. Isolated wetlands have wetland hydrology, hydric soils, and hydrophytic vegetation, but are not typically connected by surface flow to jurisdictional waters of the U.S. Waters of the U.S. were delineated to the ordinary high water mark where stream channels had a defined bed and bank (Westech 2005e). The wetland delineation completed by Westech has been subject to a jurisdictional determination by the Corps (Westech 2005e). The Corps completed a preliminary jurisdictional determination of the wetland delineation of the Poorman Impoundment Site. An approved jurisdictional determination of isolated wetlands has not been completed (Corps 2008). In the effects analysis, the lead agencies used the Corps' preliminary jurisdictional determination of the Poorman Impoundment Site.

Wetlands near the Sedlak Park substation site were not delineated according to the 1987 Corps of Engineers Wetlands Delineation Manual. Instead BPA environmental staff identified wetland boundaries based on the presence of hydric soil boundaries, secondary hydrologic indicators, and wetland vegetation (BPA 2008). Wetland boundaries were recorded using a GPS device. GPS data was used by BPA to develop a substation design that would avoid and minimize impacts to wetlands and waters of the U.S. (BPA 2008).

Impacts of the mine alternatives on wetlands were determined by calculating the number of acres that would be disturbed. MMC's wetland mapping did not distinguish open water channels from adjacent wetlands along stream channels. For example, wetlands along Little Cherry Creek as well as the Little Cherry Creek channel were mapped as riverine wetlands. To differentiate effects

on wetlands from open water, open water and channel width were subtracted from the wetland information provided by Westech and Geomatrix and incorporated into the impact analysis. The average channel width of Little Cherry Creek is around 8 feet (Geomatrix 2006d). The average channel width of the four channels in the Poorman Tailings Impoundment Site is estimated to be 2 feet (Geomatrix 2006b).

3.22.3 Affected Environment

3.22.3.1 Wetlands and Waters of the U.S.

In the analysis area, wetlands are primarily located adjacent to low terraces, overflow channels, and scoured depressions along perennial streams. Wetlands are also found in depressions and low gradient swales in the two tailings impoundment sites (Figure 85). Springs, seeps, and runoff from snowmelt and precipitation result in soil saturation or inundation during spring and early summer. Sidehill and toeslope seeps are present along portions of Little Cherry Creek. These seeps range from small discrete trickles to more extensive zones of saturation along slopes where the seepage zone may extend for more than 100 feet. Sidehill and toeslope seeps are generally saturated late into the growing season.

3.22.3.1.1 Wetland Types

Functions and values for wetlands on the Montanore Project site were evaluated using the MDT evaluation method (Geomatrix 2007e, 2008d). The MDT method uses a classification system that combines the USFWS classification system (Cowardin *et al.* 1979) with a hydrogeomorphic (HGM) (landscape position) approach (Brinson 1993). The Montana Method provides a landscape context to the Service classification. The MDT method classifies wetlands as Category I, II, III, or IV. Category I wetlands are exceptionally high quality wetlands and are generally rare to uncommon. Category II wetlands are more common than Category I wetlands, and provide habitat for sensitive plants and animals. Category III wetlands are more common than Category II or I wetlands, generally less diverse, and are often smaller than Category II or I wetlands. Category IV wetlands are generally small, isolated, and lack vegetative diversity. These wetlands provide minor wildlife habitat.

Category I, II, and III wetlands were found in the project area. Category I wetlands were found in the Little Cherry Creek Impoundment Site (Geomatrix 2008d) and Category II and III wetlands were found in the Little Cherry Creek Impoundment Site and the Poorman Impoundment Site (Geomatrix 2007e, 2008d).

Forest-dominated wetland types (riverine forested, slope forested, slope depressional forested, and slope riverine forested) are primarily found along stream corridors and seeps. This wetland type is dominated by western redcedar, western hemlock, and Engelmann spruce. Understory species include devil's club, lady fern, oakfern, arrowleaf groundsel, and common horsetail (Westech 2005e and Geomatrix 2008d).

Scrub-shrub dominated wetlands (slope scrub-shrub and riverine scrub-shrub) support Douglas spirea, thinleaf alder, alder buckthorn, and common snowberry. Understory species include inflated sedge, brown bog sedge, bluejoint reedgrass and common horsetail. Scrub-shrub dominated wetlands are found along drainages where trees have been removed by logging, around depressions, in logged swales with poor drainage, and in oxbows of the Fisher River (Westech 2005e; Geomatrix 2008d).

Herbaceous-dominated wetlands (slope emergent and depressional emergent) are wet depressions or slope areas with poorly drained soils. Sedges such as inflated sedge, beaked sedge, and knot-sheath sedge are typically the dominant species with horsetails, rushes, and other graminoids being co-dominants (Westech 2005e; Geomatrix 2008d).

3.22.3.1.2 Other Waters of the U.S.

Streams and drainages within the analysis area are other waters of the U.S. (Geomatrix 2007e). Section 3.11, *Surface Water Hydrology* contains additional descriptions of these drainages: Fisher River, Libby Creek, Ramsey Creek, Poorman Creek, Little Cherry Creek, Bear Creek, Howard Creek, Miller Creek, West Fisher Creek, Hunter Creek, Sedlak Creek, and other unnamed drainages.

3.22.3.1.3 Springs

The Corps defines springs as "any location where there is artesian flow emanating from a distinct point at any time during the growing season" (Corps 2002). In Montana, a spring is defined as a hydrologic occurrence of water involving the natural flow of water originating from beneath the land surface and arising to the surface of the ground. Any disturbances within 100 feet of a spring are regulated by the Corps (Corps 2002). Numerous springs are located in the analysis area. Spring types and locations are described in section 3.10, *Ground Water Hydrology*.

3.22.4 Environmental Consequences

3.22.4.1 Alternative 1 – No Mine

The No Mine Alternative would not disturb or affect any wetlands or waters of the U.S. Any existing wetland disturbances would be mitigated in accordance with existing permits and approvals.

3.22.4.2 Alternative 2 – MMC's Proposed Mine

3.22.4.2.1 Direct Effects

Mine Facilities

Alternative 2 would affect 33.5 acres of jurisdictional wetlands (Table 149). Most of these wetlands would be forested wetlands located in the proposed Little Cherry Creek Tailings Impoundment Site. Functional Category I, II, and III wetland types were found in the Little Cherry Creek Tailings Impoundment Site. About 0.6 acre of isolated wetlands found in small scattered locations in the Little Cherry Creek Tailings Impoundment Site would be affected. These isolated wetlands are generally small depressions resulting from logging activity (Westech 2005e). About 2.8 acres of waters of the U.S. would be affected under Alternative 2.

The 10,800-foot diversion of Little Cherry Creek, a water of the U.S., and the loss of the existing channel would affect waters of the U.S. A bridge would be used to access the Ramsey Plant site. Waters of the U.S. and wetlands in Ramsey Creek would not be affected.

Table 149. Wetlands and Waters of the U.S. within Mine Alternative Disturbance Areas.

Facility[†]	Alternative 2 – MMC's Proposed Mine	Alternative 3 – Agency Mitigated Poorman Impoundment[§]	Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment
Jurisdictional Wetlands			
Impoundment Site	32.8	9.0	33.1
Roads	0.7	0.7	0.7
Subtotal	**33.5**	**9.7**	**33.8**
Non-wetland Waters of the U.S.			
Impoundment Site	2.8	0.6	2.7
Subtotal Jurisdictional Wetlands and Waters of the U.S.	**36.3**	**10.3**	**36.5**
Isolated Wetlands			
Impoundment Site	0.6	3.3	0.6
Plant Site	0.0	0.1	0.1
Roads	<0.1	<0.1	<0.1
Subtotal	**0.6**	**3.4**	**0.7**
Total	**37.0**	**13.7**	**37.2**

All units are acres, rounded to the nearest 0.1 acre; subtotals may vary by 0.1 acre due to rounding.
[§]Two small jurisdictional wetlands and one small isolated wetland in the Poorman Impoundment Site were identified by the Corps in its preliminary jurisdictional determination. The exact size and location of these wetlands have not been determined.
[†]The LAD Areas and adits would not affect any wetlands or waters of the U.S. in any alternative; the Plant Site would not affect any jurisdictional wetlands or waters of the U.S. in any alternative;
bridges would be constructed for road crossings and would not affect any non-wetland waters of the U.S.
Source: GIS analysis by ERO Resources Corp. using wetland data in Westech 2005e and Geomatrix 2007e.

Mitigation Measures

As part of Alternative 2, one of the possible fisheries mitigation projects proposed by MMC would be to conduct a sediment-source inventory in the watershed, and stabilize, recontour, and revegetate priority source areas, which are typically roadcuts in Libby, Hoodoo, Poorman, Midas, and Crazyman creeks. Wetland delineations at these sediment source areas have not been completed. Any wetlands and waters of the U.S. disturbed during the implementation of this mitigation are not listed in Table 149. If implemented, this mitigation in the short term would increase sedimentation in area streams and adjacent wetlands and waters of the U.S. Over the long term, this mitigation may increase the function and values of any associated wetlands and would decrease sediment delivery to waters of the U.S.

3.22.4.2.2 Indirect Effects

The effect on wetlands, spring, and seep habitat overlying the mine would be the same in all mine action alternatives and difficult to predict (see section 3.10.4.2.1, *Mine Area*). The effect on plant species, functions, and values associated with the affected wetlands, springs, or seeps by a change

in water level would be best determined by relating plant species with water abundance and quality for monitoring and evaluation. Alternative 2 does not include a survey of plant species abundance (all species) prior to activity and subsequent plant species abundance and water monitoring of ground water-dependent ecosystems (GDEs) overlying the mine. Without this type of monitoring, mining-induced changes in water level or quality may result in an unidentified loss of species, functions, and values associated with the affected wetlands, springs, or seeps.

Several wetlands and springs are present between the proposed Little Cherry Creek Tailings Impoundment and Libby Creek. The pumpback well system needed to collect seepage not collected by the underdrain system would likely lower ground water levels and reduce ground water discharge to springs, seeps, and wetlands downgradient of the impoundment (see section 3.10.4.2.2, *Tailings Impoundment*). Surface flow in Little Cherry Creek downstream of the Seepage Collection Pond may cease during low flow periods. Wetlands in the area immediately adjacent to the creek may be altered by a reduction in surface and ground water flows. Species more tolerant of drier sites might replace species requiring very moist soil conditions. It is uncertain if reducing surface and ground water flows would affect the functions and values of wetlands downstream of the impoundment. MMC would monitor effects to existing wetlands downstream of the tailings impoundment. Monitoring of the downstream wetland areas would be completed annually for the first 5 years of mine operation. If functions and values of downstream wetlands were adversely affected, MMC, in cooperation with the lead agencies and the Corps, would develop additional wetland mitigation. This monitoring would not adequately detect potential changes to wetlands downstream of the tailings impoundment throughout the operation of the impoundment.

Temporary indirect effects to wetlands and waters of the U.S. would occur during construction of the proposed Little Cherry Creek Tailings Impoundment and associated facilities due to increased sediment contributions to wetlands and waters of the U.S. Proposed BMPs would reduce sediment contributions to wetlands and waters of the U.S.

3.22.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

3.22.4.3.1 Direct Effects

Mine Facilities

Alternative 3 would directly affect 9.7 acres of jurisdictional wetlands, 3.4 acres of isolated wetlands, and 0.6 acre of non-wetland waters of the U.S. (Table 149). Functional Category II and III wetland types were found in the Poorman Tailings Impoundment site. Because the Poorman Tailings Impoundment would not require diversion of a perennial stream, Alternative 3 would affect fewer wetlands compared to Alternatives 2 and 4.

Mitigation Measures

MMC would plow the Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) year-round during the 2-year evaluation program and the 1-year period during reconstruction of the Bear Creek Road. Culverts along all access roads that pose a substantial risk to riparian conditions would be replaced as necessary to comply with INFS standards, such as fish passage or conveyance of adequate flows. Any work in a RHCA along an access road would be completed in compliance with INFS standards and guidelines.

The Wildlife Mitigation Plan in Alternatives 3 and 4 includes 20.3 miles of proposed access changes during the evaluation phase and up to 20.1 miles of proposed access changes during the

construction phase in the Rock Creek, Libby Creek, and Miller Creek watersheds (Figure 36). Wetland delineations along the roads proposed for access changes have not been completed. MMC would build and maintain gates or barriers on the roads, and complete other activities so the roads would either be removed from service, or cause little resource risk if maintenance were not performed on them during the operation period of the mine and prior to their future need. In most cases, culverts would be removed; such removals would occur in active stream channels requiring instream work, structure placement, and fill removal.

The Fisheries Mitigation Plan in Alternative 3 includes implementation of sediment abatement and instream stabilization measures designed to reduce sediment contribution from the identified sediment sources in the Libby Creek watershed, and the installation of structures in bull trout critical habitat in Libby Creek between Little Cherry Creek and Bear Creek (Figure 35). Additional structures would be installed in East Fork Bull River.

Any wetlands and waters of the U.S. disturbed during the implementation of these measures are not listed in Table 149. In the short term, these activities would increase sedimentation in area streams and adjacent wetlands and waters of the U.S. After the activities were completed, and the roads became stabilized, these mitigation measures would increase the function and values of any associated wetlands and would decrease sediment delivery to waters of the U.S.

3.22.4.3.2 Indirect Effects

No springs, seeps, or wetlands have been identified below the Poorman Impoundment Site. A pumpback well system would not affect any springs, seeps, or wetlands below the impoundment.

In Alternatives 3 and 4, a GDE inventory and subsequent monitoring would be completed of a selected area overlying the proposed mine and adits and used to help evaluate indirect wetland effects. The inventory would include a vegetation survey to describe and document existing vegetation characteristics and establish "trigger" species. Trigger species would be used to assess changes in vegetation composition as described in the GDE inventory and monitoring plan. An identified spring between the two LAD Areas (SP-21 see Figure 72) would be part of the hydrology monitoring plan (Appendix C). The mitigation would not alter the effect of Alternatives 3 and 4, but would assist in determining if an impact were occurring and the scale of any impact. Loss of jurisdictional wetland resources as a result of water level or quality changes would be mitigated offsite at a 2:1 ratio. Non-jurisdictional wetlands would be mitigated offsite at a 1:1 ratio. No springs or wetlands are located downgradient of the Poorman Tailings Impoundment Site. Other temporary indirect effects of construction would be the same as Alternative 2.

3.22.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

3.22.4.4.1 Direct Effects

Mine Facilities

Alternative 4 would directly affect 33.8 acres of jurisdictional wetlands, 0.7 acre of isolated wetlands, and 2.7 acres of other waters of the U.S. (Table 149). Most effects would be in the Little Cherry Creek Impoundment Site. Functional Category I, II, and III wetlands were found in the Little Cherry Creek Impoundment site. Other temporary indirect effects of construction would be the same as Alternative 2. The diversion channel for Little Cherry Creek would be a geomorphic-type diversion that would incorporate habitat components.

Mitigation Measures

The same mitigation measures described in Alternative 3 would be implemented in Alternative 4. Any wetlands and waters of the U.S. disturbed during the implementation of the mitigation measures are not shown in Table 149. In the short term, these activities would increase sedimentation in area streams and adjacent wetlands and waters of the U.S. After the activities were completed, and the roads became stabilized, these mitigation measures would increase the function and values of any associated wetlands and would decrease sediment delivery to waters of the U.S.

3.22.4.4.2 Indirect Effects

A GDE inventory of an area overlying the mine area, subsequent monitoring of GDEs, and implementation of any mitigation would be completed in Alternative 4, as described in Alternative 3. In addition, flow from springs SP-02, SP-10, S-12, SP-14, SP-15, and SP-29 (Figure 41) would be measured twice in Alternative 4, once in early June when the area was initially accessible, and once between mid-August and mid-September 1 year before construction began. (Springs SP-02 and SP-15 would not be monitored if they were covered by impoundment facilities.) Samples from these springs would be collected 1 year before construction began and analyzed for selected water quality parameters. Sampling would be repeated every 2 years until tailings disposal ceased. At each spring, a vegetation survey would be completed 1 year before construction began; the survey and establishment of "trigger plants" would be the same as Alternative 3. At the LAD Areas, an identified spring between the two LAD Areas (SP-21 see Figure 72) would be part of the hydrology monitoring plan (Appendix C).

In Alternative 2, MMC would monitor unspecified wetlands downstream of the tailings impoundment annually for the first 5 years of mine operation. In Alternative 4, MMC would monitor three wetlands if not filled by project activities: LCC-24, LCC-25, and LCC-39 (Figure 41). MMC would use the procedures established for monitoring of wetland mitigation sites described in Alternative 3 to assess vegetation characteristics and establish "trigger" species. Trigger species would be used to assess changes in vegetation composition as described in the GDE inventory and monitoring. Samples from any standing water in these three wetlands would be collected in mid-summer 1 year before construction began and analyzed for selected parameters. Sampling would be repeated in mid-summer every 2 years until tailings disposal ceased. The mitigation would not alter the effect of Alternative 4, but would assist in determining if an impact were occurring and the scale of any impact.

3.22.4.5 Alternative A – No Transmission Line

Because no construction would occur, the No Transmission Line Alternative would have no direct or indirect effects on wetlands or other waters of the U.S.

3.22.4.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

As a basis for comparing alternatives, acreage of all wetlands and other waters of the U.S. within the transmission line clearing area was calculated. Direct effects to wetlands and waters of the U.S. are expected to be mostly avoided by placement and location of the substation, loop line, and transmission structures outside of wetlands and waters of the U.S. Unavoidable wetland direct effects would be determined during final design. Direct and indirect effects to wetlands and waters of the U.S. may occur from road construction activities.

A total of 1.6 acres of wetlands would be within the Alternative B transmission line clearing area; an additional 8.2 acres would be other waters of the U.S. (Table 150). No isolated wetlands were identified within the clearing area of any transmission line alternative. Alternative B would have the least amount of wetlands within the clearing area. Less than 0.1 acre of wetlands and waters of the U.S. and would be affected by new or upgraded road construction. The need for culverts or other crossing types at waters of the U.S. would be determined during final design. Indirect effects to wetlands from road construction would be minimized by use of drive-through dips, open-top box culverts, waterbars or crossdrains, and implementation of BMPs. The BPA would avoid all wetlands at the Sedlak Park Substation Site.

Table 150. Wetlands and Waters of the U.S. along Transmission Line Alternatives.

Type	Alternative B – North Miller Creek	Alternative C – Modified North Miller Creek	Alternative D – Miller Creek	Alternative E – West Fisher Creek
Transmission Line Clearing Area†				
Jurisdictional Wetlands	1.6	2.0	2.0	2.0
Waters of the U.S.	8.2	1.2	10.2	9.2
Areas Disturbed by New or Upgraded Roads				
Jurisdictional Wetlands	<0.1	0.0	0.0	0.0
Waters of the U.S.	<0.1	<0.1	<0.1	<0.1

All units are acres, rounded to the nearest 0.1 acre

†Acreage is based on a 150-foot clearing width for monopoles (Alternative B) and 200-foot width for H-frame structures (all other alternatives except for a short segment of the West Fisher Creek Alternative E that has monopoles). Actual acreage cleared would be less than listed and would depend on tree height, slope, and line clearance above the ground.

Source: GIS analysis by ERO Resources Corp. using MMC data.

3.22.4.7 Alternative C – Modified North Miller Creek Transmission Line Alternative

A total of 3.2 acres of wetlands and waters of the U.S. would be within the clearing area of Alternative C (Table 150). Of the 3.2 acres, about 2.0 acres would be wetlands and 1.2 acres would be waters of the U.S. Alternative C would have the least acreage of waters of the U.S. compared to the other alignments. Indirect and direct effects to wetlands and waters of the U.S. would be avoided where practicable during structure placement. Less than 0.1 acre of wetlands and waters of the U.S. would be affected by new or upgraded road construction. Indirect effects would be minimized through BMPs and appropriate stream crossings.

3.22.4.8 Alternative D – Miller Creek Transmission Line Alternative

A total of 12.2 acres of wetlands and waters of the U.S. would be within the clearing area of Alternative D (Table 150). Of the 12.2 acres, 2.0 acres would be wetlands and 10.2 acres would be waters of the U.S. Alternative D would have more waters of the U.S. within the clearing area. Less than 0.1 acre of wetlands and waters of the U.S. would be affected by new or upgraded road construction. Indirect effects would be minimized through BMPs and appropriate stream crossings.

3.22.4.9 Alternative E – West Fisher Creek Transmission Line Alternative

A total of 2.0 acres of wetlands and 9.2 acres of other waters of the U.S. would be within the clearing area of Alternative E (Table 150). Less than 0.1 acre of wetlands and waters of the U.S. would be affected by new or upgraded road construction. Indirect effects would be minimized through BMPs and appropriate stream crossings.

3.22.4.10 Proposed Mitigation and Monitoring Plans

A variety of mitigation measures would be used to minimize wetland effects during construction and operation. These measures would include BMPs, such as silt fence, revegetation of disturbed areas, and restoration of temporary wetland effects. Placement of transmission line structures would likely avoid wetlands.

The Corps has established minimum ratios for compensatory mitigation in the Omaha District. Wetland establishment should be no less than 2:1 for all jurisdictional wetlands. Mitigation for streams should be at a 1:1 ratio. The stream must be the same length and width as the impacted stream area (Corps 2005). The Corps typically does not establish mitigation ratios for non-jurisdictional wetlands.

Available information for the mitigation sites was reviewed to estimate function categories that are consistent with those used for existing wetlands at the Montanore site (Geomatrix 2008c). For wetland mitigation sites greater than 5 acres (Ramsey site and one South Poorman site), the wetland functions and values are Category II; for wetland mitigation sites less than 5 acres (North Poorman site, Little Cherry site, and one South Poorman site), the wetland functions and values are Category III (Geomatrix 2008c).

3.22.4.10.1 Alternative 2 – MMC's Proposed Mine

MMC has developed a conceptual Wetland Mitigation Plan designed to replace wetlands lost from project activities as described in section 2.4.6.1, *Wetland Mitigation Plan*. Wetland mitigation would involve on-site and off-site locations. MMC proposes to replace forested and herbaceous wetlands at a 2:1 ratio and herbaceous/shrub wetlands at a 1:1 ratio. Annual monitoring of mitigation sites would ensure mitigation sites were dominated by hydrophytic vegetation and had comparable function and value to the affected wetlands. MMC's proposed monitoring plan is described in section 2.4.6.1.3, *Monitoring*. Vegetation, soils, and hydrology data would be collected annually until the Corps has determined that wetland mitigation success was achieved. On-site mitigation opportunities would involve wetland restoration and wetland creation. Opportunities for wetland mitigation include sites along Little Cherry Creek. A total of 8.8 acres of on-site mitigation is proposed for Alternative 2 (Table 151) (Figure 21). Off-site mitigation would occur outside the permit area boundary. A total of 35.8 acres of off-site mitigation would mitigate for effects associated with Alternative 2 (Table 151). Most mitigation sites would be located in the Poorman Creek area. The Corps would be responsible for developing final mitigation ratios, depending on the function and values of the affected wetlands. Replacing herbaceous/shrub wetlands at a 1:1 ratio would not meet the minimum Corps mitigation ratio (Corps 2005).

3.22.4.10.2 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

The agencies' Wetland Mitigation Plan for Alternative 3 is described in section 2.5.7.1, *Wetland Mitigation*. Alternative 3 would have the highest (17.5 acres) on-site mitigation compared to the other alternatives. Most mitigation for Alternative 3 would be located at the South Little Cherry

Creek site (15.3 acres) (Figure 34). Jurisdictional wetlands would be replaced at a ratio described in Alternative 2 while non-jurisdictional wetlands would be replaced at a 1:1 ratio. Shallow wells would be used to assess whether ground water is adequate to support wetlands if the mitigation sites were excavated to near the ground water surface. Only sites with adequate existing ground water available to support wetlands would be used for mitigation. Where feasible, wetland soil, sod, and shrubs would be excavated from existing wetlands prior to filling during construction, and placed in the wetland mitigation areas. Use of existing wetland soils in mitigation would improve mitigation success. A total of 6.7 acres of wetland mitigation would be available off-site for Alternative 3 along the Ramsey Creek mitigation site. According to MMC, the Ramsey Creek mitigation site is part of an existing man-made wetland. MMC would conduct a wetland delineation of the proposed area during final design to ensure the wetland is jurisdictional. The Corps would be responsible for developing final mitigation ratios within the mitigation plan, depending on the function and values of the affected wetlands. Sufficient mitigation sites have been identified to achieve the Corps' minimum ratios.

The agencies' wetland monitoring plan for Alternative 3 is described in section 2.5.7.1.2, *Monitoring of Wetland Mitigation Sites*. The revised monitoring plan would better evaluate the functions and values of the mitigation sites.

3.22.4.10.3 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

The agencies' Wetland Mitigation Plan for Alternative 3 is described in section 2.6.6.1, *Wetland Mitigation*. Alternative 4 would have 2.2 acres of on-site mitigation available along Little Cherry Creek (Table 151) (Figure 34). Jurisdictional wetlands would be replaced at a ratio described in Alternative 2 while non-jurisdictional wetlands would be replaced at a 1:1 ratio. A total of 33.8 acres of off-site mitigation would be available for Alternative 4. Off-site mitigation is comparable to Alternative 2. The Corps would be responsible for developing final mitigation ratios, depending on the function and values of the affected wetlands. Mitigation sites identified for Alternative 4 are insufficient to achieve the Corps' minimum ratios, and additional mitigation sites would be necessary if this alternative were permitted.

Where feasible, wetland soil, sod, and shrubs would be excavated from existing wetlands prior to filling during construction, and placed in the wetland mitigation areas. Use of existing wetland soils in mitigation would improve mitigation success.

According to MMC, the Poorman Weather Station mitigation site is not within an area of existing wetlands and has no well-defined drainage. Wetlands created at this site may not be jurisdictional if the site did not have a hydrologic connection to a jurisdictional water. If the wetlands adjacent to the proposed mitigation sites were not jurisdictional, additional mitigation sites would be developed.

In Alternative 2, MMC would use ground water collected from beneath the Little Cherry Creek Tailings Impoundment to create and maintain wetlands at one or more sites. Ground water beneath the tailings impoundment may be mixed with tailings water, and contain elevated nutrients and metal concentrations. Use of ground water beneath the tailings impoundment would not provide hydrologic support after operations cease. As proposed in Alternative 3, 1 year of ground water monitoring at the mitigation sites would be implemented in Alternative 4. Only sites with adequate existing ground water available to support wetlands would be used for mitigation.

Table 151. On- and Off-site Wetland Mitigation Opportunities by Alternative.

Mitigation Type and Site Name	Alternative 2 – MMC's Proposed Mine	Alternative 3 – Agency Mitigated Poorman Impoundment	Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment
On-Site			
Little Cherry Creek	2.2	2.2	2.2
Little Cherry Creek Diversion Channel	1.6	0.0	0.0
South Little Cherry Creek	0.0	15.3	0.0
Unspecified Little Cherry Creek Site	5.0	0.0	0.0
Total On-Site	**8.8**	**17.5**	**2.2**
Off-Site			
North Poorman Creek	3.4	0.0	3.4
South Poorman Creek	9.7	0.0	9.7
Poorman Weather Station	14.0	0.0	14.0
Libby Creek Recreational Gold Panning Area	2.0	0.0	0.0
Ramsey Creek	6.7	6.7	6.7
Total Off-Site	**35.8**	**6.7**	**33.8**
Total Mitigation	**44.6**	**24.2**	**36.0**

All units are in acres rounded to the nearest 0.1 acre.
Wetlands mitigation sites are shown for Alternative 2 on Figure 21 and for Alternatives 3 and 4 on Figure 34.
Source: GIS analysis by ERO Resources Corp. using MMC data.

The agencies' wetland monitoring plan for Alternative 4 is similar to Alternative 3, as described in section 2.6.6.1.2, *Monitoring of Wetland Mitigation Sites*. Additional monitoring for Alternative 4 is described in section 2.6.5.1, *Ground Water Dependent Ecosystem Inventory and Monitoring*. In Alternative 4, flow from springs SP-02, SP-10, S-12, SP-14, SP-15 and SP-29 (Figure 41) would be measured and sampled for selected water quality parameters. MMC would monitor three wetlands if not filled by project activities: LCC-24, LCC-25, and LCC-39 (Figure 41). MMC would use the procedures established for monitoring of wetland mitigation sites described in Alternative 3 to describe and document existing vegetation characteristics and establish trigger species. Trigger species would be used to assess changes in vegetation composition as described in the GDE inventory and monitoring plan. Samples from any standing water in these three wetlands would be collected and analyzed for selected water quality parameters. Sampling would be repeated in mid-summer every 2 years until tailings disposal ceased. The revised monitoring plan would better evaluate the functions and values of the mitigation sites and the effects on downstream springs and wetlands.

3.22.4.11 Cumulative Effects

Past actions in the analysis area, particularly road construction, has resulted in the placement of culverts and other fill material in streams and adjacent wetlands. Past actions after the passage of the Clean Water Act in 1977 were subject to Section 404 permitting and mitigation requirements. These past actions have unlikely affected the overall function and values of the wetlands within

analysis area ecosystems. Cumulative direct and indirect effects to waters of the U.S. may result from other reasonably foreseeable actions in the analysis area such as other mining operations and road construction. All present and reasonably foreseeable future actions would be subject to Corps' permitting and mitigation requirements. With appropriate mitigation, cumulative direct wetland effects would be negligible. Cumulative indirect effects from reasonably foreseeable future actions in the area may include small amounts of increased sedimentation in wetlands from new roads associated with construction and ground-disturbing activities such as Miller-West Fisher Vegetation Management Project, and projects on private land such as housing development, roads, and logging.

3.22.4.12 Regulatory/Forest Plan Consistency

All of the action alternatives would involve the discharge of fill material or excavation into wetlands or waters of the U.S. As mentioned in section 3.22.1, *Regulatory Framework*, the Corps regulates these activities under Section 404 of the Clean Water Act. MMC would apply for a permit and be required to follow conditions in the Section 404 permit. Plans for avoidance, minimization, and mitigation of effects to wetlands would be required prior to permit issuance. The Corps will discuss compliance with the 404(b)(1) Guidelines in its ROD for its decision on the Section 404 permit. Any alternative permitted by the Corps would comply with the KFP.

3.22.4.13 Irreversible and Irretrievable Commitments

All action alternatives would result in an irretrievable commitment of wetlands and other waters of the U.S. Successful mitigation would restore lost wetlands and provide similar functions and values to altered wetlands at another location. All action alternatives would affect wetlands and create changes in wetland functions and values. Some biodiversity in wetlands may ultimately be lost from invasion of introduced species and be irreversible under all action alternatives. Any differences in the function and values of the existing Little Cherry Creek channel and the proposed diversion channel in Alternatives 2 and 4 would be an irretrievable commitment.

3.22.4.14 Short-term Uses and Long-term Productivity

Short-term effects to wetlands and waters of the U.S. would occur during construction activities due to increased sediment contributions. Proposed BMPs would minimize sedimentation. Other potential short-term effects would result from time delays between the loss of existing wetlands resources and the development of the viable wetlands with similar functions and values.

3.22.4.15 Unavoidable Adverse Environmental Effects

A loss of wetland functions and values, biodiversity, and species composition would occur in all action alternatives where wetlands are affected. All wetlands would be mitigated and wetland functions and values would return to the area in time. Wetlands biodiversity and species composition would not return to predisturbance levels.

3.23 Wilderness and Inventoried Roadless Areas

3.23.1 Regulatory Framework

3.23.1.1 Wilderness

The Wilderness Act directs the Forest Service to protect the natural character of the wilderness and to provide for recreational, scenic, scientific, educational, cultural, and historical uses of wilderness areas. Based on the Wilderness Act's definition of wilderness, the Forest Service uses four attributes to describe wilderness:

- Natural integrity
- Apparent naturalness
- Outstanding opportunities for solitude
- Opportunities for primitive recreation

Natural integrity is the extent to which long-term ecological processes are intact and operating. Apparent naturalness focuses on how the area is perceived by the general public. Solitude is isolation from sights, sounds, and the presence of others. Primitive recreation provides opportunities for isolation from the evidence of man and may involve a high degree of challenge or risk and honed outdoor skills. These attributes are applied to the conditions inside the boundaries of the wilderness. While the experience of wilderness visitors might be affected by activities outside the wilderness boundary, the Wilderness Act does not regulate activities outside the wilderness.

3.23.1.2 Inventoried Roadless Areas

Inventoried roadless areas (IRAs) are defined as "undeveloped areas typically exceeding 5,000 acres that met the minimum criteria for wilderness consideration under the Wilderness Act and that were inventoried during the Forest Service's Roadless Area Review and Evaluation (RARE II) process, subsequent assessments, or forest planning" (USDA Forest Service 2003b). In 2001, the USDA adopted the Roadless Area Conservation Rule (36 CFR 294), which established prohibitions of road construction and reconstruction and timber harvesting in IRAs on National Forest System lands, with certain exceptions. On August 12, 2008, the Federal District Court for the District of Wyoming, declared that the 2001 Roadless Area Conservation Rule was promulgated in violation of the NEPA and the Wilderness Act. The court held "the roadless rule must be set aside" and that "[t]herefore, the Court ORDERS that the Roadless Rule, 36 CFR §§ 294.10 to 294.14, be permanently enjoined, for the second time." Previously, the Federal District Court for the Northern District of California issued an order that reinstated the 2001 roadless rule, including the Tongass-specific amendment, and specified that "federal defendants are enjoined from taking any further action contrary to the [2001] Roadless Rule....." On December 2, 2008, the Federal District Court for the Northern District of California issued an order in which "the Court partially stays its injunction as to states outside the Ninth Circuit and New Mexico, pursuant to Rule 62(c). The injunction remains in full effect in all other respects."

The IRAs are areas identified by the Forest Service for consideration of their suitability for inclusion in the National Wilderness Preservation System. Attributes of IRAs include primitive

recreation opportunities, opportunities for solitude, natural integrity and appearance, manageability and boundaries, and special features (USDA Forest Service 1993).

3.23.2 Analysis Area and Methods

3.23.2.1 Analysis Area

The analysis area encompasses the CMW located west of all proposed surface facilities in all alternatives, and the Cabinet Face East IRA just east of the CMW (Figure 86). Although other IRAs are shown on Figure 86, they would not be affected by any of the alternatives, and are not discussed further.

3.23.2.2 Methods

Potential effects to the CMW were qualitatively evaluated based on potential impacts to wilderness attributes from the proposed project. The analysis of effects on IRAs was qualitatively based on indirect effects on IRA attributes and quantitatively based on direct effects on IRAs. Data on the IRA attributes were taken from the KFP (USDA Forest Service 1987).

3.23.3 Affected Environment

3.23.3.1 Cabinet Mountains Wilderness

The CMW is a 94,272-acre unit of the National Wilderness Preservation System. It is about 34 miles long and varies from 0.5 to 7 miles wide (Figure 86). The wilderness occupies the upper elevations of the Cabinet Mountains, with elevations from 2,500 to 8,700 feet. The Cabinet Mountains are a north/northwest trending extensively glaciated mountain range. This glaciation has produced spectacular features such as high craggy peaks, vertical cliffs, knife-edge ridges, amphitheater-like basins, and filled valley bottoms. These land-building processes also have created many streams and about 85 lakes within the wilderness.

3.23.3.1.1 Wilderness Attributes

Natural integrity is the extent to which long-term ecological processes are intact and operating. This attribute describes how human influences alter natural processes by comparing an area's condition to its probable state after human contact. Apparent naturalness is closely related to natural integrity. Both qualities may be altered by the same activities. Apparent naturalness focuses on how the activities are perceived by the general public. The CMW has a high degree of existing natural integrity and apparent naturalness. Vegetation in the CMW is abundant and varied, ranging from delicate harebells growing in rock fissures to the lush, valley bottom stands of old growth cedar and hemlock. Thirteen species of conifer trees, 130 species of wildflowers, and numerous shrub species are known to grow in the wilderness. Many wildlife species inhabit the area within and adjacent to the wilderness. These include the grizzly bear, black bear, elk, bighorn sheep, mountain goats, lynx, mule deer, white-tailed deer, and various small mammals and birds.

Solitude is isolation from sights, sounds, and the presence of others. The developments and evidence of man do not appear. Features that contribute to solitude include size of area and distance from perimeter to center. Vegetation and topographic screening are also related to solitude. The narrow configuration of the CMW (less than a mile wide at its narrowest point) has

caused some pressures to occur at some of the more popular destination sites, such as Leigh Lake. The relatively easy access has also resulted in some sites receiving heavy use and visitor impacts.

Primitive recreation provides opportunities for isolation from the evidence of man. Visitors may enjoy a high degree of challenge and risk, and use of outdoor skills. The CMW offers opportunities for primitive recreational activities in a pristine setting. Hiking is the most popular activity in the wilderness. Fishing, photography, and hunting are the next most common activities pursued by wilderness visitors. The wilderness is split between Sanders and Lincoln counties. Access from the Lincoln County side is provided by 12 trails that are maintained on 1- to 2-year intervals and 19 trails are maintained on 3- to 4-year intervals. Access from the Sanders County side is provided by nine maintained trails and six trails not regularly maintained.

3.23.3.1.2 Management

Management of the CMW is shared by three Ranger Districts of the KNF. To determine the type and extent of management actions appropriate for different portions of the wilderness, the Forest Service has identified two distinct opportunity classes for wilderness. The opportunity classes are delineated according to the biological and social setting within the wilderness.

Opportunity Class I includes pristine areas of the wilderness that are without recreation trails. Game trails or other obvious ways or routes may have light use by backpackers; almost no stock use occurs. Many remote basins and valleys without fishable lakes, combined with little evidence of recreational use, leads to abundant opportunity for solitude.

Opportunity Class II includes a delineation of trail corridors and more heavily used lake basins. Several lakes in this class are stocked with fish and have relatively easy access. In the analysis area, the lake basins and the trail corridors accessing them total less than 15 percent of the wilderness acres but account for most of the recreation use. Some of the heavily used lakes in the analysis area are Leigh, Rock, and Geiger. Campsites in Class II have developed from repeated visitor use of the same place. These are often in poor locations, impacting both the biological and social environment. A typical lake basin in the wilderness has two to five recognizable campsites. Use patterns and activities have resulted in eroding trails, bare compacted soils, damaged vegetation, campfire remnants, litter, and sanitation problems. Management emphasis is on rehabilitation of overused areas, obliteration of unacceptable sites, information dissemination, and education of wilderness users to prevent further degradation (USDA Forest Service and DEQ 2001).

In 2005, the Forest Service established a monitoring framework for wilderness that includes four qualities. These four qualities set a foundation for future monitoring:

- Untrammeled – wilderness is essentially unhindered and free from modern human control or manipulation
- Undeveloped – wilderness is essentially without permanent improvements or modern human occupation
- Natural – wilderness ecological systems are substantially free from the effects of modern civilization

- Outstanding opportunities for solitude or a primitive and unconfined type of recreation – wilderness provides outstanding opportunities for people to experience solitude or primitive and unconfined recreation, including the values of inspiration and physical and mental challenge

3.23.3.2 Inventoried Roadless Areas

The Cabinet Face East IRA lies just east of the CMW and extends about 36 miles south from Libby (Figure 86). The area includes about 50,200 acres of National Forest System lands and about 800 acres of private lands. The average width is about 2 miles. This IRA provides attributes and recreational opportunity similar to those found in the CMW. The Forest Service identified the following attributes for the Cabinet Face East IRA (USDA Forest Service 1987).

3.23.3.2.1 Natural Integrity and Appearance

The Cabinet Face East IRA excludes most improvements and all roads, leaving it very natural appearing. Only one man-made feature within the IRA is noticeable, the Scenery Mountain Lookout.

3.23.3.2.2 Opportunities for Solitude

The Cabinet Face East IRA offers abundant opportunities for solitude due to the relatively low annual visitation and the lack of motorized roads.

3.23.3.2.3 Primitive Recreation Opportunities

Primitive recreation opportunities available in the Cabinet Face East IRA include hiking, hunting, stream fishing, and horseback riding. Challenging experiences are available such as rock climbing on the steep rock faces and cross-country ski touring, primarily in the south half of the roadless area.

3.23.3.2.4 Roadless Area Manageability and Boundaries

Cabinet Face East IRA is a long, linear roadless area with boundaries easily defined in some places and less so in others. Less definable boundaries are due to the exclusion of some narrow drainage corridors on the eastern side where roads exist. The IRA spans the length of the CMW on its east side and provides a buffer zone to it, making the CMW more manageable for wilderness characteristics.

3.23.3.2.5 Special Features

The Cabinet Face East IRA has many special features including grizzly bear, goat, and moose habitat and views of historical mining activity. Ramsey Lake, a very small lake surrounded by old growth, is also a special scenic feature within the analysis area. The lake receives very little recreational use.

The Cabinet Face East IRA may also possess other roadless characteristics and values, such as high quality or undisturbed soil, water, and air; potential sources of public drinking water; diversity of plant and animal communities; habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land; reference landscapes; traditional cultural properties and sacred sites; and other locally identified unique characteristics. Other sections of this EIS, such as sections 3.18, *Soils and Reclamation* and 3.24, *Wildlife Resources*, describe these characteristics and values in the analysis area.

3.23.4 Environmental Consequences

3.23.4.1 Wilderness

3.23.4.1.1 Alternative 1 – No Mine

The CMW would not be directly affected by additional mine facilities. Sounds associated with existing activities at the Libby Adit Site would be audible within a small portion of the CMW in the upper Libby Creek drainage. Such activities on private land at the Libby Adit Site would remain until reclaimed in accordance with existing permits and approvals. Noise levels in the CMW would return to low, ambient levels when reclamation was completed.

3.23.4.1.2 Alternative 2 – MMC Mine Proposal

All proposed surface disturbances and activities would occur outside the CMW boundary. The experience of wilderness visitors may be affected by mining-related activities outside the wilderness boundary. As discussed in section 3.16, *Scenery*, portions of the Montanore Project would be visible from at least one key viewpoint within the CMW at Elephant Peak. The Libby Adit Site, the Ramsey Plant Site, and the Little Cherry Creek Tailings Impoundment would potentially be visible from the CMW locations west of the facilities. The proposed Rock Lake Ventilation Adit, located adjacent to Rock Lake on a small parcel of private land within the CMW, would potentially be visible from within the CMW, although surface features at the ventilation portal would be minimal. Night lighting of the mine facilities would be visible from portions of the CMW west of the facilities. Areas cleared of timber for mine facilities would be visible from some locations within the CMW. The visual effects of mining operations would be noticeable during construction and operations and would diminish following facility reclamation and closure.

As discussed in section 3.19, *Sound, Electrical and Magnetic Fields, Radio and TV Effects*, noise from mining facilities would be higher than existing levels in the CMW. During construction, operation, and reclamation, noise from generators, fans, equipment, traffic, and plant operations would extend westward into the CMW, with about 55 dBA at the CMW boundary diminishing to about 30 dBA along the ridge between Elephant Peak and Eagle Peak. Following mine closure and reclamation, noise levels in the CMW would return to pre-mine levels. Elevated noise levels would occur periodically from traffic and monitoring activities following reclamation. Noise levels would return to pre-mine levels over the long term.

Because the wilderness experience is highly personal and individual, the perceived effect would differ among individuals. It is likely that the visual and noise effects of the project would reduce the natural quality of the wilderness experience for some individuals in portions of the wilderness. Visitation in the portions of the CMW exposed to sound and visual effects could decrease. Other qualities such as untrammeled, undeveloped, and outstanding opportunities for solitude or a primitive and unconfined type of recreation may also be diminished at some locations within the CMW for visitors while the project was in operation. These effects would occur throughout the duration of project operations and diminish following mining and reclamation.

3.23.4.1.3 Alternative 3 – Agency Mitigated Poorman Impoundment Site

Impacts to wilderness attributes and qualities would be similar to Alternative 2. Some mine facilities and roads would be visible from locations within the CMW. Noise levels in CMW would reach 30 dBA along the ridge between Elephant Peak and Ojibway Peak. Night lighting

also would be visible from portions of the CMW. In Alternatives 2 and 4, MMC would shield or baffle night lighting at all facilities, minimizing effects on night sky.

Effects to visual quality and increased levels of noise would diminish wilderness attributes for apparent naturalness, opportunities for solitude, and for primitive recreation of the wilderness experience from some locations in the CMW under Alternative 3. These effects would occur throughout the duration of project operations and diminish following mining and reclamation.

3.23.4.1.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Site

Impacts to wilderness attributes and qualities from the Plant and Adit sites would be the same as Alternative 3; the impoundment would have the same effects as Alternative 2. Some mine facilities and roads would be visible from certain viewpoints within the CMW. Noise levels would be similar to Alternative 3, and night lighting also would be visible from portions of the CMW. Effects to visual quality and increased levels of noise would diminish wilderness attributes for apparent naturalness, opportunities for solitude, and for primitive recreation of the wilderness experience from some locations in the CMW under Alternative 4.

3.23.4.1.5 Alternative A – No Transmission Line

In Alternative A, generators would be used to provide power to mine facilities. Noise levels in CMW would reach 30 dBA along the ridge between Elephant Peak and Ojibway Peak. Following mine closure and reclamation, noise levels in the CMW would return to pre-mine levels.

3.23.4.1.6 Effects Common to Alternatives B, C, D and E

None of the alternative transmission lines would encroach on CMW. Views from within the CMW would be affected by a new transmission line, particularly from high, open vistas such as Elephant Peak within the CMW. The visual effects of the transmission line alternatives from viewpoints within the CMW have been discussed in section 3.16, *Scenery*. None of the transmission line alternatives would affect wilderness attributes.

3.23.4.2 Inventoried Roadless Areas

3.23.4.2.1 Alternative 1 – No Mine

Alternative 1 would not directly affect the Cabinet Face East IRA. Sounds associated with the closure and reclamation of the Libby Adit Site would be audible within portions of the Cabinet Face East IRA in the Libby Creek drainage. Noise levels in the IRA would return to low, ambient levels when monitoring is completed.

3.23.4.2.2 Alternative 2 – MMC's Mine Proposal

Mine facilities in Alternative 2 would directly affect about 44 acres, or about 0.1 percent, of the Cabinet Face East IRA in the Ramsey Creek drainage. Timber harvest in the IRA would occur at the Ramsey Plant Site and a portion of LAD Area 1, and a road to the Ramsey Adits and LAD Area 1 would be built in the IRA. The Libby Adit Site, the Ramsey Plant Site, and the Little Cherry Creek Tailings Impoundment also would be visible from portions of the IRA. Night lighting at some mine facilities would be visible from the IRA. Roads and clearing areas may be visible from locations with high or open vantage points. Visual effects would be noticeable during construction and operations, and diminish following facility reclamation and closure. The visual effects of Alternative 2 have been discussed in section 3.16, *Scenery*. Sound levels between 30 and 45 dBAs would be audible for distances up to 1 mile from the eastern boundary of the IRA (Big Sky Acoustics 2006). Sound levels have been discussed in section 3.19, *Sound, Electrical*

and Magnetic Fields, Radio and TV Effects. The Cabinet Face East IRA boundary is segmented on the eastern edge by narrow corridors that exclude the roads in several drainages including Ramsey Creek (Figure 86). These narrow corridors will allow for some non-conforming uses adjacent to the IRA. The project would have no direct effect on Ramsey Lake, but would restrict access to it. The plant site would be located about 1,000 feet northeast of the lake. The noise level at Ramsey Lake would increase to about 55 dBA.

Natural Integrity and Appearance

Alternative 2 would not change the overall appearance of the Cabinet Face East IRA, but would affect the appearance of the IRA in locations nearest the direct impact. Changes in natural integrity and apparent naturalness would occur at the edges of the Cabinet Face East IRA in the Ramsey Creek drainage by the Ramsey Plant site and LAD Area 1.

Opportunities for Solitude

Proposed facilities in Ramsey Creek and Little Cherry Creek drainages also would reduce a person's opportunity for solitude on the east side of the Cabinet Face East IRA from Libby Creek watershed north to Bear Creek watershed because of the increased sound levels that would be generated by mine operations. Following mine closure and reclamation, noise levels and opportunities for solitude in the IRA would return to pre-mine conditions.

Primitive Recreation Opportunities

Views of the Libby Adit Site, the Ramsey Plant Site, and the Little Cherry Creek Tailings Impoundment from high or open locations in the IRA may affect some visitors' primitive recreational experience. Alternative 2 would eliminate access to portions of the Ramsey Creek drainage beyond LAD Area 1, eliminating recreational opportunities in those portions of the IRA. Access to Poorman Creek also would be restricted under Alternative 2. The access restriction would continue for the life of the project. Due to the restricted access and noise levels, visitors to the area also would likely no longer make Ramsey Lake a destination under this alternative during the project's life. Primitive recreation opportunities would not be affected in the rest of the roadless area. Primitive recreation opportunities would return to pre-mine levels after mine closure and reclamation.

Special Features

Access to Ramsey Lake would be restricted and noise levels would be high enough to deter visitation during the life of the project.

Manageability and Boundaries

The IRA affected by the Ramsey Plant Site and LAD Area 1 in the Ramsey Creek drainage would potentially prevent the establishment of a future wilderness boundary in Ramsey Creek. Manageability and boundaries would return to pre-mine conditions after mine closure and reclamation.

3.23.4.2.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would avoid direct impacts to the IRA west of LAD Area 1 and at the Ramsey Plant Site. No road construction or timber harvest would occur in the IRA. Increased noise levels from the Libby Plant Site would be audible from within the IRA between Libby and Ramsey creeks. Similar noise levels would be audible from within the IRA west of LAD Area 1. Adverse visual

impacts from within the IRA would be similar to Alternative 2. IRA attributes would return to pre-mine conditions after mine closure and reclamation.

3.23.4.2.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Effects on the IRA would be similar to Alternative 3 due to similar positioning of the facilities in and near Libby Creek. No road construction or timber harvest would occur in the IRA. Visual impacts from within the IRA would be similar to Alternative 2.

3.23.4.2.5 Alternative A – No Transmission Line

In Alternative A, generators would be used to provide power to mine facilities. Increased noise levels from the Libby Plant Site would be audible from within the IRA between Libby and Ramsey creeks. IRA attributes would return to pre-mine conditions after mine closure and reclamation.

3.23.4.2.6 Alternative B MMC's Proposed Transmission Line (North Miller Creek Alternative)

MMC's proposed North Miller Creek transmission line alignment would physically disturb about 2 acres of the Cabinet Face East IRA in the Ramsey Creek drainage. Timber harvest for line clearing would occur in the IRA. The small area disturbed in the IRA would not directly affect the primitive recreation opportunities and other features, opportunities for solitude, roadless area manageability and boundaries, or special features and special values. The steel monopoles, new roads and associated timber harvest, which would be required under Alternative B, would parallel the IRA boundary along most of Ramsey Creek, and would be visible from some viewpoints within the IRA, particularly high, open vistas. These views also may contribute to a loss of opportunities for solitude for some visitors to the IRA. The visual effects of the transmission line alternatives from some viewpoints within the IRA have been discussed in section 3.16, *Scenery*. Noise from transmission line construction would be audible in the IRA adjacent to Ramsey Creek. IRA attributes would return to pre-transmission line conditions after transmission line decommissioning.

3.23.4.2.7 Effects Common to Alternatives C, D, and E

The other three transmission line alternatives would avoid physical disturbance in the Cabinet Face East IRA. No road construction or timber harvest would occur in the IRA. Transmission line construction to the Libby Plant Site would be audible in the IRA between Libby and Ramsey creeks. Views from the IRA would be affected by new H-frame transmission lines, particularly from high, open vistas. The visual effects of the transmission line alternatives from some viewpoints within the IRA have been discussed in section 3.16, *Scenery*. IRA attributes would return to pre-transmission line conditions after transmission line decommissioning.

3.23.4.3 Cumulative Effects

Past actions have not substantially altered the attributes of the CMW or the Cabinet Face East IRA. The existing Libby Adit is visible from some locations in the CMW and the Cabinet Face East IRA. Development of the reasonably foreseeable Rock Creek Project likely would have similar effects on wilderness and roadless areas as those described for development of the Montanore Project. The Rock Creek Project would not be visible from key viewpoints identified for the Montanore Project scenery analysis. Other viewpoints within the CMW would be affected by the Rock Creek Project. The Snowshoe Mine and Snowshoe Creek CERCLA Project, which would remove tailings from the Snowshoe Mine Site, would occur adjacent to the CMW and IRA

boundaries (Maxim 2004). Noise from this activity in combination with the Montanore Project may have an effect on wilderness and IRA visitors. Wilderness visitors at some locations also may be affected by the clearing of timber for any of these future project facilities. The cumulative effects of the Rock Creek Project, the Snowshoe Project, and the Montanore Project might contribute to a loss of wilderness attributes desired by some individuals.

The Rock Creek Project would not affect the Cabinet Face East IRA and would not contribute to the cumulative effects on Cabinet Face East IRA. Libby Creek Ventures plans to drill three boring holes in the Libby Creek drainage outside of the Cabinet Face East IRA, which may increase activity and noise in the drainage and in nearby parts of the IRA for up to one week. About 1 acre of land is planned for clearing. This activity in combination with the Montanore Project may have a short-term adverse cumulative effect upon visitors to the IRA and the CMW.

3.23.4.4 Regulatory/Forest Plan Consistency

None of the mine and transmission line alternatives would physically disturb any lands within the CMW. While the experience of wilderness visitors might be affected by activities outside the wilderness boundary, the Wilderness Act does not regulate activities outside the wilderness. Consequently, all mine and transmission line alternatives would be in compliance with the KFP regarding the CMW.

Mine Alternative 2 and transmission line Alternative B would require road construction and timber harvest within the Cabinet Face East IRA. MMC has valid existing rights to access the minerals proposed for mining with the Montanore Project, and road construction and timber harvest in the Cabinet Face East IRA are necessary for the development of those rights. The other mine and transmission line alternatives would not require road construction and timber harvest within the Cabinet Face East IRA. The experience of IRA visitors might be affected by activities outside the IRA boundary.

3.23.4.5 Irreversible and Irretrievable Commitments

None of the alternatives would result in an irreversible and irretrievable commitment of resources within the CMW. Wilderness experiences for some visitors may be irretrievably affected from specific viewpoints within the CMW under any of the alternatives. Alternative 2 and MMC's proposed North Miller Creek transmission line alternative would irretrievably devote small portions of the Cabinet Face East IRA to mining uses over the life of the project. Roadless area attributes would be irretrievably affected in the Ramsey Creek drainage under Alternative 2.

3.23.4.6 Short-term Uses and Long-term Productivity

In the short term, development of the project under Alternative 2 would affect the consideration of a small portion of the Cabinet Face East IRA in the Ramsey Creek drainage for permanent designation as wilderness during the project's life due to the project facilities' direct disturbance of the IRA. In the long term, areas that were cleared of timber for facilities would be visible from a number of key viewpoints, both in the CMW and the Cabinet Face East IRA, resulting a long-term impact to the visual quality of some visitor's experience.

3.23.4.7 Unavoidable Adverse Environmental Effects

Under Alternative 2, noise levels would be increased from the Ramsey Plant Site up to the ridge between Elephant Peak and Eagle Peak in the CMW. Under Alternatives 3 and 4, noise levels

would increase from the Libby Plant Site up to the ridge between Elephant Peak and Ojibway Peak. Under all alternatives, night lighting would be visible from some locations of the CMW. Therefore, all mine and transmission line action alternatives would reduce the opportunities for solitude in both the CMW and the Cabinet Mountains East IRA. Wilderness natural qualities in certain areas also would be affected under all action alternatives. Under Alternative 2, primitive recreation opportunities would no longer exist in the Ramsey Creek drainage within the IRA due to the unavoidable physical impacts, presence of facilities, increased noise levels, and night lighting.

3.24 Wildlife Resources

3.24.1 Introduction

The KNF area contains habitat for more than 300 different species of wildlife (USDA Forest Service 2003c), many of which occur on the Libby Ranger District (District) and within the Montanore Project analysis area. The Forest Service and the FWP work together to ensure that an appropriate balance is maintained between habitat capability and population numbers. The Forest Service also works closely with the USFWS to assist in the recovery of animals listed under the ESA. Proposed federal actions that have the potential to impact species protected by the ESA require consultation with the USFWS.

Wildlife resources selected for detailed analysis represent a combination of fine filter (species-specific) and coarse filter (management indicator species) analyses. The USFWS requires endangered, threatened, and proposed species be included in an effects analysis. Any effects to Forest Service-sensitive species, which are designated by the Regional Forester, also are disclosed. The evaluation of impacts to Montana Species of Concern is part of the Major Facility Siting Act (MFSA) transmission line certification process. Management Indicator Species (MIS) are identified in the KFP and represent a particular habitat or habitat complex. Each MIS represents a group of species that share common habitat components required for sustained growth and successful reproduction. This section is comprised of six subsections: key habitats, MIS, Forest Service sensitive species, federal threatened and endangered species, migratory birds, and other species of interest, namely moose and Montana Species of Concern.

The analysis area for each species was determined based on viability analysis concepts described by Ruggiero *et al.* (1994), which take into consideration biological populations and ecological scale. Evaluation of species viability is based on concepts and direction provided in the forest-wide conservation plan (Johnson 2004a). The KNF is comprised of eight planning units, which are geographic areas based on sub-basins. Each planning unit contains several Planning Subunits (PSUs), which are management areas generally based on watersheds. With the exception of threatened and endangered species, unless otherwise indicated, the analysis area for National Forest System lands consists of the PSUs potentially affected by the project. The analysis area is the Crazy and Silverfish PSUs (Figure 87). The eastern segments of the transmission line alternatives are located on private land (Figure 77). Potential impacts to wildlife resources on private land are evaluated qualitatively and are not included in most habitat calculations conducted to assess compliance with numeric standards, objectives, and guidelines in the KFP. Assessment of effects on private land is discussed in each subsection. Cumulative effects for most wildlife resources are analyzed for the KNF and any non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments. Analysis areas for threatened and endangered species are based on management areas defined in recovery plans and any additional non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments.

The wildlife analysis includes a description of existing conditions (the affected environment created by all past and current management practices and natural events), and direct, indirect, and cumulative effects of the project alternatives.

3.24.2 Key Habitats

Key habitats play a particularly important role in the survival and success of the most vulnerable wildlife species. While some species can be found in a variety of habitats, many are less adaptive and are restricted to more limited habitats. This section describes the characteristics and importance of cavity habitat provided by snags and woody debris. Old growth forests, riparian areas, and wetlands, which are also key habitats, have been discussed in sections 3.21, *Vegetation* and 3.22, *Wetlands and Other Waters of the U.S.* Effects on wildlife species associated with cavity habitat are evaluated in the pileated woodpecker analysis discussed in section 3.24.3, *Management Indicator Species*.

3.24.2.1 Regulatory Framework

The KFP establishes forest-wide objectives, standards, guidelines, and monitoring requirements for cavity habitat. Recommendations for down wood are described in the Fisher Landscape Assessment (USDA Forest Service 2003d) and are incorporated by reference. According to KFP guidelines (USDA Forest Service 1987), to maintain viable populations of primary excavators, commercial forest lands should include at least 0.9 snags per acre (40 percent of the estimated maximum potential cavity-nester population level, or PPL) and riparian areas should include a minimum of 1.35 snags per acre (60 percent of the PPL). For down wood, current KFP guidelines are to leave 5 to 15 tons of large (greater than 12 inches diameter) down wood per acre.

The MFSA directs the DEQ to approve a facility if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impacts, considering the state of available technology and the nature and economics of the various alternatives. FWP is required to report DEQ information relating to the impact of the proposed site on FWP's area of expertise. The report may include opinions as to the advisability of granting, denying, or modifying the certificate.

3.24.2.2 Snags and Woody Debris

3.24.2.2.1 Analysis Area and Methods

The analysis area for direct and indirect impacts on habitat provided by snags and down wood in the KNF includes the Crazy and Silverfish PSUs. PSUs are sufficiently large to cover home range sizes of species associated with snag and down wood habitat structure. To evaluate potential direct and indirect impacts of the transmission line on cavity habitat on private and state land, the analysis area includes all non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments. The cumulative effects analysis area for cavity habitat is comprised of the Crazy and Silverfish PSUs and any non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments.

Because KFP standards for riparian habitat, as amended by the INFS, ensure the 60 percent cavity nester PPL (potential population level) standard for riparian areas in the KNF, the following analysis focuses on the general forest standard of 40 percent PPL. The effects indicators for snag and down wood habitat in the KNF are: 1) percent of the estimated maximum cavity-nester population by PSU; and 2) acres of snag and down wood habitat removed.

The percent of the PPL was estimated based on Thomas (1979). The percent PPL was calculated by multiplying the snag level percent by the percent of area with that snag level (ibid.). Snag levels were derived from field data based on the following conservative approach:

- Old growth and untreated forest stands provide 2.5 snags per acre, which is considered 100 percent snag level (Tincher 1998).
- Partial cut stands provide 1.35 snags per acre, or at least 60 percent snag level (Johnson and Lamb 1998).
- Regeneration (harvested) units provide 0 to 80 percent snag level, depending on period of harvest. Units harvested prior to the KFP, and those planned prior to 1987 but harvested through 1992, essentially provide no cavity habitat and have a snag level of 0 (Johnson and Lamb 1998), unless site-specific data shows otherwise. Units harvested after the 1987 KFP (1993-2002) provide at least 40 percent snag level, or 0.9 snags per acre (USDA Forest Service 2003b).
- Roads provide 0 percent snag level. Roads account for 4 acres per mile of disturbance (average 33 feet wide times 5,280 feet per mile divided by 43,560 square feet per acre).
- Snag densities adjacent to open roads are the same as snag densities adjacent to closed roads (Bate and Wisdom 2004). While some snags are lost due to firewood cutting, according to Tincher (1998), snag levels within 200 feet of open roads range from 40 to 80 percent. Snag densities have been shown to decrease with proximity to towns (Bate and Wisdom 2004), and forest-wide, visual observations suggest that snag levels adjacent to roads can be as low as zero. Because firewood cutting is allowed from any open road, retention of snags within 200 feet of the road over time is highly unlikely. Thus, a worst-case scenario, or total snag loss, was assumed within 200 feet on each side of a road. This results in zero snag potential on an additional 49 acres per mile of road (400-foot buffer total width x 5,280 feet per mile divided by 43,560 square feet/acre – rounded to next whole acre).

For the Crazy PSU, data sources for snag and down wood habitat include District surveys for old growth and harvested units. Surveys for downed wood and snags are included as part of old growth surveys. Old growth survey methods are described in section 3.21, *Vegetation*. A description of the survey procedure used for existing harvest units is available in the KNF project record. Snag surveys in both old growth and harvested stands in the Crazy PSU cover about 7,502 acres. These surveys recorded snags in diameter classes based on wildlife habitat needs. Data was collected on coarse wood material more than 10 inches in diameter.

Site-specific snag and down wood survey data for the Silverfish PSU is incomplete. Information from the TSMRS was used to estimate snag densities for the Silverfish PSU. Details regarding TSMRS are available in the District files.

The analysis area includes private and state lands crossed by the eastern segments of the alternatives transmission line alignments (Figure 77). Quantitative snag and down wood information is not available for private or state-owned lands in the analysis area, much of which has been logged in the past 20 to 30 years. Current snag and down wood availability on private land was estimated based on vegetation mapping shown on Figure 83 and likely past and current land use practices.

3.24.2.2.2 Affected Environment

Snags, broken topped live trees, live cull trees, and down logs are used by a great variety of wildlife species for nesting, denning, perching, roosting, feeding, and shelter. On the KNF, 42 species of birds, 14 species of mammals, and several species of amphibians are recognized as

largely dependent on cavity habitat (snags and down wood). Table 152 summarizes the existing cavity habitat potential on National Forest System lands in the Crazy and Silverfish PSUs. The following discussion describes existing conditions relative to KFP objectives and guidelines, and a similar analysis was not done for private lands.

Table 152. Existing PPL on National Forest System lands in the Crazy and Silverfish PSUs.

Habitat Component	Acres	Percent of PSU	Total Snags per Acre	Snags per Acre at Managed Snag Level[1]	Snag Level[2] (%)	Potential Population Level (%)[2]
Crazy PSU						
Old growth surveyed for snags[3]	6,157	10	3.83	2.25	100	10
Remaining old growth and untreated forest	30,162	50	No site-specific data	2.25	100	50
Units harvested from 1985 – 1997[3]	1,345	2	3.25	0.9	100	2
Past Regen. Harvest (1997 – present)[4]	577	<1	No site-specific data	0.9	40	<1
Partial Cut Forest[5]	5,806	10	No site-specific data	1.35	60	6
Roads and buffer (53 acres per mile)[6]	15,103	25	N/A	0.0	0	0
Non-forest Habitat[7]	1,065	2	N/A	0.0	0	0
Total Forest Lands in Crazy PSU	60,215	100	N/A	N/A	N/A	69
Silverfish PSU						
Old Growth and Untreated Forest	40,782	67	No site-specific data	2.25	100	67
Past Regen. Harvest (1993 – present)[4]	522	1	No site-specific data	0.90	40	<1
Past Regen. Harvest Prior to 1993)[4]	3,449	6	No site-specific data	0.00	0	0
Partial Cut Forest[5]	5,629	9	No site-specific data	1.35	60	6
Roads and buffer (53 acres per mile)[6]	10,139	17	N/A	0.00	0	0
Non-forest Habitat[7]	0	0	N/A	0.00	0	0
Total Forest Lands in Silverfish PSU	60,521	100	N/A	N/A	N/A	73

See footnotes on next page.

N/A = not applicable
[1] The managed snag level is the number of snags per unit of area >10" diameter at breast height (dbh) selected as a management goal, based on values from Thomas 1979, Tincher 1998, Johnson and Lamb 1998, Bate and Wisdom 2004, and KNF forest-wide observations for worst-case scenario.
[2] Percent of sub-unit (expressed as decimal) times snag level percent equals proportionate PPL for each habitat component. The sum of proportionate PPLs from all habitat components is the PPL for the PSU (Thomas 1979). If actual snags per acre (Crazy PSU only) are equal to or greater than snags per acre at the managed snag level, then managed snag level applies. For the Silverfish PSU, managed snag level is used.
[3] District snag survey data for the Crazy PSU. Includes all snags >10" dbh. For the Silverfish PSU, PSU-specific data are not available.
[4] Regeneration harvest from TSMRS database and includes activity codes: 4100 thru 4149. Snags per acre and snag level based on Johnson and Lamb 1998.
[5] Partial cut forest data from TSMRS database and includes activity codes: 4150 thru 4241. Snags per acre and snag level based on Johnson and Lamb 1998.
[6] Snags per acre and snag level based on Tincher 1998, Bate and Wisdom 2004, and KNF forest-wide observations for worst-case scenario.
[7] Based on KNF GIS data layers for the following Vegetative Response Units: Grassland Steppe, Mountain Bottomlands, Agricultural Lands, Rural/Urban, Rock/Scree/Ice, and Water.
Source: GIS analysis by ERO Resources Corp. using KNF data.

The existing PPL on National Forest System lands in the Crazy PSU is 69 percent, while the PPL on National Forest System lands in the Silverfish PSU is 73 percent (Table 152). The PPL for both PSUs are greater than the 40 percent PPL recommended in the KFP. According to the 1997 KFP Monitoring Report (USDA Forest Service 1998b), KNF cavity excavator PPL was 88.7 percent. The 2002 report (USDA Forest Service 2003c) indicates that 95 percent of the compartments monitored meet or exceed KFP standards for PPL, the 40 percent PPL is being met in the KNF, and the KNF is providing sufficient cavity habitat at the drainage or compartment scale as well as the forest scale. KFP riparian standards, as amended by INFS, ensure the 60 percent level is being met in those areas.

Historically, wildfires have played a large role in the amount of down wood in the forests (Graham *et al.* 1994). Depending on the frequency, intensity, and magnitude of fires, ponderosa pine forests could have more than 45 tons per acre of down wood while western white pine forests could have more than 268 tons per acre of down wood. The longer period of time between fires, the longer the down wood would remain. During the last 100 years, the frequency of fires in the northern Rocky Mountains has been greatly reduced, potentially resulting in larger amounts of down wood. Results of surveys of down wood in the Crazy PSU and portions of the Silverfish PSU shown in Table 153 suggest that KNF guidelines of 5 to 15 tons of down wood per acre are being met in old growth and past harvest areas.

Table 153. Down Wood Greater than 10 inches in Diameter in the Crazy and Silverfish PSUs.

PSU	Down Wood Survey Sites	Acres Surveyed	Tons/Acre (average)*
Crazy	Old growth	6,157	31
Crazy	Past timber harvest units	2,569	41
Silverfish	Old growth	2,404	23
Silverfish	Past timber harvest units	Data not available	Data not available

*Current KFP guidelines are to leave 5 to 15 tons of large (greater than 12" diameter) down wood per acre.
Source: KNF District files.

Because downed wood material in the 3 to 9 inch range was not tallied, the total tonnage was likely underestimated. Tonnage also varied considerably in the past harvest units. This was likely due to site preparation methods used after timber harvest, and the number of snags and standing trees left after harvest, which could eventually be recruited to the forest floor.

Although data are incomplete for the Silverfish PSU, the KFP directs that sufficient amounts of large downed wood material be retained on-site for wildlife habitat needs, nutrient release back into the soil, and site protection for timber stand regeneration. The current KFP direction (KFP Vol. 2, A16-6) is to meet timber/silviculture guideline #9, which is to leave logs greater than 12-inch diameter scattered through out harvest units (a few pieces per acre). Five to 15 tons per acre is recommended. Current management activities in the Silverfish PSU are designed to meet guideline #9.

The majority of the non-National Forest System lands in the analysis area is heavily roaded and has been logged in the past 20 to 30 years (Figure 83), and it is not likely that snags have been left standing. As a result, snag and down wood is likely to be less available on private and state lands.

3.24.2.2.3 Environmental Consequences

Impacts to snag habitat and changes in PPL from the various project features of the mine and transmission line alternatives are shown in Table 154 and Table 155, and described in the following subsections.

Table 154. Impacts on Snag Habitat and Potential Population Level in the KNF by Mine Alternative.

Activity	[1] No Mine/Existing Conditions	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative	[4] Agency Mitigated Little Cherry Creek Impoundment Alternative
Facility Construction (Tailings Impoundment, Plant Site, and Other Facilities) (acres)	0	1,605	1,044	1,151
Road Construction and Improvement (acres)	0	108	100	99
Total Disturbance Impacts (acres)	0	1,713	1,144	1,250
Percent Potential Population Level				
Crazy PSU (percent)	69 (0)	66 (-3)	67 (-2)	67 (-2)
Silverfish PSU (percent)	73 (0)	73 (0)	73 (0)	73 (0)

Number in parentheses is percent change from [1] No Mine/Existing Conditions.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 155. Impacts on Snag Habitat and Potential Population Level in the KNF by Transmission Line Alternative.

Activity	[A] No Transmission Line/Existing Conditions	[B] MMC's Proposed Transmission Line (North Miller Creek Alternative)	[C] Modified North Miller Creek Transmission Line Alternative	[D] Miller Creek Transmission Line Alternative	[E] West Fisher Creek Transmission Line Alternative
Road Construction and Improvement (acres)	0	87	51	63	63
Transmission Line Clearing and Construction (acres)	0	70	91	96	170
Total Disturbance Impacts (acres)	0	157	142	159	233
Percent Potential Population Level					
Crazy PSU (percent)	69 (0)	68 (-1)	69 (<-1)	69 (<-1)	69 (<-1)
Silverfish PSU (percent)	73 (0)	72 (-1)	73 (<-1)	73 (<-1)	72 (-1)

Number in parentheses is percent change (+/-) due to alternative.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Alternative 1 – No Mine

In Alternative 1, no disturbance and no direct impacts on snags would occur. Cavity habitat would be available at current levels for wildlife use. The addition or loss of snags would depend on other factors, such as firewood cutting, wind events, natural attrition, or wildfire. The level of impact from these factors cannot be calculated due to the high uncertainty in predicting occurrence and intensity levels. This alternative would not change the current condition or availability of down wood within the PSU.

Alternative 2 – MMC Proposed Mine

Snags and down wood would be cleared within most of the disturbance boundaries for Alternative 2. Alternative 2 would result in the disturbance of 1,713 acres due to facility and road construction. Most disturbance would occur on National Forest System lands, although some private land would be disturbed (Figure 77). Surface disturbance associated with Alternative 2 would result in a long-term (125 to 150 years), site-specific reduction in suitable cavity habitat for species (*e.g.*, pileated woodpeckers) that do not nest in open areas. About 1,350 acres would be cleared for the tailings impoundment and associated components, which would likely encompass the entire home range territories of many cavity-nesting species. In the long term, some reclaimed

areas would provide cavity-nesting habitat as the forest matured. Implementation of MMC's proposed Wetland Mitigation Plan (see section 2.4.6.1, *Wetland Mitigation Plan*) would ensure that impacts to snag habitat in riparian areas on National Forest System lands would be minimized.

At the PSU scale, Alternative 2 would result in a 3 percent decrease in PPL in the Crazy PSU; the PSU would remain greater than the 40 percent level recommended in the KFP. Alternative 2 would have no effects on snag habitat in the Silverfish PSU. Based on available data (Table 153), existing levels of down wood in the Crazy PSU are greater than KFP guideline levels; Alternative 2 would cause the loss of all down wood on 1,713 acres. Based on the available data for existing conditions (Table 153), adequate down wood habitat would remain available in the Crazy PSU.

Alternative 2 would result in noise and other disturbances associated with blasting, construction of the plant and adit sites, road construction and use, and plant and adit operations that could deter some wildlife from using nearby snags and down wood. Disturbance impacts would likely be greatest during the construction phase, but may persist through mine operations. Impacts of human-caused disturbance from Alternative 2 on species associated with snag and down wood habitat structure for the pileated woodpecker are described in section 3.24.3, *Management Indicator Species*.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Impacts to snag and down wood habitat from Alternative 3 would be similar to Alternative 2 except that there would be less surface disturbance and a smaller decrease in PPL. Alternative 3 would result in the disturbance of 1,144 acres due to facility and road construction and would result in a 2 percent decrease in PPL. About 927 acres would be cleared for the tailings impoundment and associated components, which would likely encompass the entire home range territories of many cavity-nesting species.

Similar to Alternative 2, implementation of the agencies' Wetland Mitigation Plan (see section 2.5.7.1, *Wetland Mitigation*) would ensure that impacts to snag habitat in riparian areas on National Forest System lands would be minimized. KNF riparian standards and guidelines, as amended by the INFS, would ensure that impacts to snag habitat in riparian areas on National Forest System lands would be minimized. Impacts to snag and down wood habitat on National Forest System land and private land also would be minimized in Alternative 3 through implementation of the Vegetation Removal and Disposition Plan developed for agencies' alternatives discussed in section 2.5.3.2.1, *Vegetation Removal and Disposition*.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Relative to the other mine alternatives, Alternative 4 would affect snag habitat less than other mine alternatives. The impacts to snag and down wood habitat from Alternative 4 would be the same as Alternative 3, except that there would be less surface disturbance. Alternative 4 would result in the disturbance of 1,250 acres of National Forest System land due to facility and road construction. About 1,034 acres would be cleared for the tailings impoundment and associated components, which would likely encompass the entire home range territories of many cavity nesting species.

Alternative A – No Transmission Line

In Alternative A, no disturbance and no direct impacts on snags would occur. The addition or loss of snags would be dependent on other factors, such as firewood cutting, wind events, natural

attrition, or wildfire. Alternative A would not change the current condition or availability of down wood within the PSU.

Alternative B – MMC Proposed Transmission Line

Alternative B would result in the disturbance of 157 acres due to facility and road construction. About 129 acres of disturbance would occur on private land (Figure 77). The majority of the private land that would be disturbed by Alternative B is heavily roaded and has been logged in the past 20 to 30 years, and likely provides less snag and down wood habitat than National Forest System lands. Vegetation would be cleared from access roads, pulling and tensioning sites, and within the transmission line clearing area. Surface disturbance would result in a long-term (125 to 150 years), site-specific reduction in suitable cavity habitat for species (*e.g.*, pileated woodpeckers) that do not nest in open areas. In the long term, some reclaimed areas would provide cavity-nesting habitat as the forest matured. Portions of the clearing area would not require clearing, such as high spans across valleys, and trees would be maintained in these areas. New roads would not be open to the public, would undergo interim reclamation after construction, and would be bladed and recontoured to match existing topography at mine closure; therefore, areas adjacent to new roads would not likely reduce snag levels from firewood gathering.

At the PSU scale, snag levels in Alternative B would decrease by 1 percent in the Crazy and Silverfish PSUs, but would remain greater than the 40 percent recommended in the KFP. Based on available data (Table 153), existing levels of down wood in the Crazy and Silverfish PSUs appear to be greater than KFP guideline levels; Alternative B would likely have minimal impacts on the availability of down wood in either PSU.

Impacts to snag and down wood habitat on KNF, state, and private land would be minimized through implementation of the Environmental Specifications (Appendix D). Implementation of KNF riparian standards and guidelines, as amended by the INFS (USDA Forest Service 1995), and the Environmental Specifications also would ensure that impacts to snag habitat in riparian areas would be minimized.

Alternative B would result in noise from helicopters during line stringing that may temporarily deter some wildlife from using nearby snags and down wood. Similar effects would occur from other transmission line construction activities where helicopters were not used, and would be more extensive for Alternative B than the agencies' alternatives. Disturbance impacts would be short-term and, with the exception of line inspection and maintenance activities, would cease after transmission line construction until decommissioning. Helicopter use and other construction activities would cause similar disturbances with similar durations during line decommissioning. Impacts of human-caused disturbance from Alternative B on species associated with snag and down wood habitat structure for the pileated woodpecker are described in section 3.24.3, *Management Indicator Species*.

Alternative C – Modified North Miller Creek Transmission Line Alternative

Impacts to snags and down wood for Alternative C would be the same as Alternative B, except that there would be less surface disturbance and a smaller decrease in PPL, helicopter disturbance during construction could last up to 2 months longer where helicopters were used for clearing and line construction, and construction activities where helicopters are not used would be less extensive. Alternative C would result in the disturbance of 142 acres due to road construction and

transmission line clearing, while the PPL in the Crazy and Silverfish PSUs would not be measurably affected.

Impacts of Alternative C on snag and down wood habitat on KNF and private land would be minimized through implementation of the Wetland Mitigation Plan, the Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*) developed for agencies' alternatives, and the Environmental Specifications (Appendix D).

Alternative D – Miller Creek Transmission Line Alternative

Impacts to snags and down wood for Alternative D would be the same as Alternative C, except that there would be slightly more surface disturbance. Alternative D would result in the disturbance of 159 acres due to road construction and transmission line clearing.

Alternative E – West Fisher Creek Transmission Line Alternative

Relative to the other transmission line alternatives, Alternative E would affect snag habitat the most. The impacts to snag and down wood habitat from Alternative E would be the same as Alternative D, except that there would be more surface disturbance and a larger decrease in PPL in the Silverfish PSU. Alternative E would result in the disturbance of 233 acres due to facility and road construction and would result in a 1 percent decrease in PPL in the Silverfish PSU.

Combined Mine-Transmission Line Effects

Impacts from combined mine-transmission line alternatives on snag and down wood habitat are shown in Table 156.

Relative to other action alternatives, combined Alternative 2B would result in the greatest impacts on the availability of snags and down wood, directly disturbing 1,870 acres, and resulting in a 5 percent decrease in PPL for the Crazy PSU, and a 1 percent decrease in PPL for the Silverfish PSU. Snag habitat cleared for the tailings impoundment and associated components would range between 927 acres for Alternatives 3C, 3D, and 3E and 1,351 acres for Alternatives 2B, 2C, and 2D. In all alternatives, the area impacted by the construction of the tailings impoundment would likely encompass the entire home range territories of many different cavity-nesting species. Combined Alternative 3C would have the least impacts on cavity habitat, resulting in 1,286 acres of habitat disturbance. All of the combined agencies' alternatives would result in a 3 percent decrease in the PPL in the Crazy PSU and would not measurably change the PPL in the Silverfish PSU. In all combined action alternatives, the PPL would remain greater than the 40 percent recommended in the KFP, and it is likely that down wood would continue to be available at levels greater than recommended in the KFP.

The majority of the private land that would be disturbed by the combined action alternatives is heavily roaded and has been logged in the past 20 to 30 years, and likely provides more limited snag and down wood habitat than National Forest System lands. Vegetation would be cleared from access roads, pulling and tensioning sites, and within the transmission line clearing area. Surface disturbance would result in a long-term (125 to 150 years), site-specific reduction in suitable cavity habitat for species (*e.g.*, pileated woodpeckers) that do not nest in open areas. In the long term, some reclaimed areas would provide cavity-nesting habitat as the forest matured. Portions of the clearing area would not require clearing, such as high spans across valleys, and trees would be maintained in these areas. New roads would not be open to the public; therefore, areas adjacent to new roads would not likely have reduced snag levels from firewood gathering.

Table 156. Impacts on Snag Habitat and Potential Population Level in the KNF by Combined Mine-Transmission Line Alternative.

Activity	[1] No Mine Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Alternative		
		TL-B	TL-C	TL-D	TL-E	TL-C	TL-D	TL-E
Facility Construction (Tailings Impoundment, Plant Site, and Other Facilities) (acres)	0	1,605	1,044	1,044	1,044	1,151	1,151	1,151
Road Construction and Improvement (acres)	0	195	151	163	163	150	162	162
Transmission Line Clearing and Construction (acres)	0	70	91	96	170	91	96	170
Total Disturbance Impacts* (acres)	0	1,870	1,286	1,303	1.377	1,392	1,409	1,483
Percent Potential Population Level (PPL)								
Crazy PSU (percent)	69	64 (-5)	66 (-3)	66 (-3)	66 (-3)	66 (-3)	66 (-3)	66 (-3)
Silverfish PSU (percent)	73	72 (-1)	73 (0)	73 (0)	72 (-1)	73 (0)	73 (0)	72 (-1)

TL = Transmission Line Alternative.
Number in parentheses is percent change (+/-) due to Alternative.
*May be slightly greater than actual impacts due to areas of overlap between mine and transmission line disturbance areas.
Relative total disturbance impacts of different alternatives may differ from relative PPLs due to the distribution of disturbance between the Crazy and Silverfish PSUs.
Source: GIS analysis by ERO Resources Corp. using KNF data.

In all combined action alternatives, impacts to snag and down wood habitat on National Forest System, state, and private land would be minimized through implementation of MMC's or the agencies' Wetland Mitigation Plan (see sections 2.4.6.1 and 2.5.7.1, *Wetland Mitigation*) and the Environmental Specifications (Appendix D). Implementation of KNF riparian standards and guidelines, as amended by the INFS, and the Environmental Specifications also would ensure that impacts to snag habitat in riparian areas would be minimized. Impacts to snag and down wood habitat on National Forest System and private land also would be minimized in the combined agencies' alternatives through implementation of the Vegetation Removal and Disposition Plan discussed in section 2.5.3.2.1, *Vegetation Removal and Disposition*.

All combined action alternatives would result in noise and other human-caused disturbances from activities associated with blasting, construction of the plant and adit sites, road construction and use, plant and adit operations, and helicopter use. Disturbance from helicopter use and other transmission line construction activities are described above for Alternatives B and C. Disturbance impacts would likely be greatest during the construction phase, but could persist through mine operations.

Cumulative Effects

Past actions, particularly timber harvest, road construction, fire suppression, and firewood gathering activities, have contributed to a reduction in large snags and down wood (USDA Forest Service 2003b). Firewood cutting and gathering would continue to occur where open roads provided access to forest habitat, contributing to snag and down wood removal. Continuing development of private lands, including timber harvest, home construction, and land clearing, would contribute to losses of cavity habitat in the analysis area. The Miller-West Fisher Vegetation Management Project would include regeneration harvest of about 475 acres, slash treatment of 681 acres, and prescribed burning of 3,751 acres of National Forest System lands in the Silverfish PSU. Timber harvest and other clearing activities planned for the Miller-West Fisher Vegetation Management Project would contribute to cumulative losses of snags and down wood in the Silverfish PSU. Activities associated with the Miller-West Fisher Vegetation Management Project are expected to retain cavity habitat within KFP-recommended levels for the Silverfish PSU. Also, while prescribed burns associated with the Miller-West Fisher Vegetation Management Project would consume some snags and down wood, it also would create snags and down wood by killing live trees. Snags and down wood created in burned areas would provide both feeding and nesting habitat for cavity-nesting birds such as the pileated woodpecker. Other reasonably foreseeable actions would involve minimal disturbance to snags and down wood.

The No Action alternatives (Alternatives 1 and A) would not contribute to cumulative losses of snags and down wood, and would not contribute to cumulative effects on cavity-nesting habitat. In combination with other reasonably foreseeable actions, the mine and transmission line action alternatives would likely result in cumulative reductions in PPL in the analysis area. Given the current levels of snags and down wood, and the overall surface area that would be impacted, it is likely in all action alternatives that the resulting PPL would remain greater than the KNF-recommended minimum level, and that sufficient cavity habitat to maintain viable populations of cavity nesters would remain in the KNF. While the action alternatives would contribute to losses of snag and down wood on private and state lands, the quality of habitat for cavity-nesters is likely relatively low in these areas due to past and current land use practices.

3.24.2.2.4 Regulatory/Forest Plan Consistency

None of the alternatives would change the PPL below the KFP-recommended levels in either the Silverfish or Crazy PSU. In all alternatives, the KFP cavity habitat standard (40 percent PPL) in MAs 11, 12, and 14-18 would be met. MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*. The requirement to retain habitat in MA 10 would continue to be met because none of the disturbance associated with the action alternatives would occur in MA 10.

Given the current amounts of down wood available in the analysis area, it is likely that in all action alternatives, down wood would continue to be available in quantities recommended in the KFP. For all alternatives KFP direction for snags and down wood would continue to be met and would contribute to the viability of associated species.

3.24.2.3 Irreversible and Irretrievable Commitments

All action alternatives would result in an irreversible commitment of cavity habitat provided by snags and down wood in the analysis area. Recruitment of snags and down wood would not occur until forest communities re-established and matured, a process that would likely require more than 100 years following disturbance.

Noise, dust, and the presence of humans and machinery associated with the action alternatives could cause some cavity-nesters to avoid nearby habitat, resulting in irretrievable commitments of cavity habitat.

3.24.2.4 Short-term Uses and Long-term Productivity

Losses of snags and down wood resulting from the action alternatives would be long-term, lasting beyond the reclamation phase. If reclamation were successful, snag and down wood densities could be restored to pre-project levels, but only after a considerable length of time.

3.24.2.5 Unavoidable Adverse Environmental Effects

Unavoidable adverse environmental effects would occur from all action alternatives in the analysis area where snags and down wood would be directly removed and where cavity nesters would avoid nearby habitat.

3.24.3 Management Indicator Species

As specified in the KFP, MIS may serve as surrogates for species with similar breeding and foraging habitat requirements, providing a tool for more accurately monitoring more than 300 different species of wildlife (USDA Forest Service 2003c) that occupy the KNF. MIS were chosen based on the following criteria: (1) the species can be easily monitored and (2) the species is susceptible to changes resulting from management activities. It is assumed that effects on MIS can be correlated to effects on other species with similar habitat requirements.

3.24.3.1 Regulatory Framework

Under NFMA guidelines, Forest Plans shall "provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives…" (16 USC 1604(g)(3)(B)). The KFP states "the maintenance of viable populations of existing native and desirable non-native vertebrate species, as monitored

through indicator species, would be attained through the maintenance of a diversity of plant communities and habitats" (KFP Vol. 1, II-22). The MIS designated for the KNF and the habitat they are intended to represent are identified in the KFP (KFP Vol. 2, Appendix 12), and shown in Table 157.

Table 157. KNF Management Indicator Species.

Species	Habitat Represented	Comments
Grizzly Bear (*Ursus arctos*)	General Forest	See section 3.24.5, *Threatened, Endangered, and Proposed Species*
Gray Wolf (*Canis lupus*)	General Forest	See section 3.24.4, *Forest-Sensitive Species*
Bald Eagle (*Haliaeetus leucocephalus*)	Rivers and Lakes	See section 3.24.4, *Forest-Sensitive Species*
Peregrine Falcon (*Falco peregrinus*)	Cliffs	See section 3.24.4, *Forest-Sensitive Species*
Elk (*Cervus elaphus*)	General Forest	
White-tailed Deer (*Odocoileus virginianus*)	General Forest	
Mountain Goat (*Oreamnos americanus*)	Alpine	
Pileated Woodpecker (*Dryocopus pileatus*)	Snag Habitat, Old Growth	See sections 3.21.2, *Old Growth Ecosystems* and 3.24.2, *Key Habitats*

The MIS described in this section are elk, white-tailed deer, mountain goat, and pileated woodpecker. Impacts to the grizzly bear are addressed in section 3.24.5, *Threatened, Endangered, and Proposed Species* and impacts to the bald eagle, peregrine falcon, and gray wolf are described in section 3.24.4, *Forest-Sensitive Species*.

Elk and white-tailed deer are MIS species that represent similar habitat (general forest). The KNF and the FWP have developed management emphasis designations for elk by PSU (Johnson 2004a). Management emphasis ratings are high in PSUs where maintaining elk security is a high priority, medium where elk are one of the primary resource considerations, and low where elk management is not a priority. The PSUs potentially affected by the Montanore Project are the Crazy and Silverfish PSUs. The Crazy PSU is assigned a medium elk emphasis rating, while the Silverfish PSU is assigned a high elk emphasis rating. Based on these management emphasis ratings, KFP direction, the biological potential of the area, state wildlife management objectives, public comments during scoping, information contained within the Kootenai Conservation Plan (Johnson 2004a), and site-specific knowledge of deer and elk use in the Crazy and Silverfish PSUs, the elk was selected as the general forest indicator for the Silverfish PSU and the white-tailed deer was selected as the general forest indicator for the Crazy PSU.

The MFSA directs the DEQ to approve a transmission line if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impact,

considering the state of available technology and the nature and economics of the various alternatives. An assessment of effects on big game species is part of the transmission line certification process. FWP is required to report DEQ information relating to the impact of the proposed site on FWP's area of expertise. The report may include opinions as to the advisability of granting, denying, or modifying the certificate.

3.24.3.2 Elk

3.24.3.2.1 Analysis Area and Methods

Elk population ecology, biology, habitat description, and relationships identified by research are described in Murie (1979) and Toweill and Thomas (2002). That information is incorporated by reference. Elk population and harvest data come primarily from FWP. Additional information is provided by recent District wildlife observation records and KNF historical data (NRIS FAUNA).

The analysis area for evaluating direct and indirect project impacts to individuals and their habitat on the KNF is the Silverfish PSU (Figure 87). The analysis areas for determining direct, indirect, and cumulative effects in the KNF are the FWP hunting district (HD) 104 and the KNF, respectively. To evaluate potential direct and indirect impacts of the transmission line on elk on private and state land, the analysis area includes all non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments. The Silverfish PSU and any non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments is the analysis area for cumulative effects on elk.

The effects analysis in the KNF is based on direction provided in the KFP (as amended) and Lyon *et al.* (1985). Additional guidance is provided by Hillis *et al.* (1991). Data sources used in this analysis include FWP hunting and population data, research, and plans; District vegetation layers; INFRA roads layers; TSMRS data; Summerfield (1991); and field surveys by District biologists and data collection crews. Potential effects to elk in the KNF are evaluated according to five effects indicators: cover/forage ratio, forage openings, habitat effectiveness (HE), security, and key habitat features. These indicators are described below.

As described in section 2.4.6.3, *Grizzly Bear Mitigation Plan*, MMC's proposed Alternatives 2 and B include an access change in NFS road #4724 from April 1 to June 30 and the year-long change in a segment of NFS road #4784 to mitigate for impacts to grizzly bears. NFS road #4784 is proposed for access change by the Rock Creek Project, and is no longer available for Montanore Mine mitigation. The agencies' alternatives would include yearlong access changes through the installation of barriers or gates in National Forest System roads to mitigate for the loss of big game security and impacts to grizzly bear. These road access changes are taken into account in elk HE, elk security, and road density calculations. Additional road access changes may also occur on land acquired as part of the grizzly bear mitigation proposed by MMC or the agencies (see sections 2.4.6.3, *Grizzly Bear Mitigation Plan* and 2.5.7.3, *Wildlife Mitigation*). Elk HE, elk security, and road density calculations do not take into account the effect of land acquisition programs proposed by MMC and the agencies. Other mitigation measures incorporated into MMC's or the agencies' alternatives that could benefit elk include winter construction timing restrictions in elk winter range, prohibiting employees from carrying firearms, and monitoring road-killed animals along mine access roads to determine if improved access resulted in increased wildlife mortality.

Impacts to elk on private and state land from the transmission line corridor were evaluated based on FWP winter habitat mapping (Figure 87); elk security generated from KNF roads data; FWP hunting and population data, research, and plans; KNF and FWP information on wildlife linkage areas; and mapping of broad vegetation types shown on Figure 83.

Cover/Forage Ratios

An important consideration when evaluating big game habitat is the distribution of cover and forage within a given area. Cover can be described as vegetation that provides protection from weather, predators, and humans. Two types of cover are considered for this analysis: hiding and thermal cover, based on Thomas (1979). Hiding cover is defined as vegetation capable of hiding 90 percent of an elk from human view at 200 feet. Thermal cover is defined as stands of conifers at least 40 feet tall with 70 percent crown closure. Forage areas are natural or man-made areas that do not qualify as either hiding or thermal cover. Reexamination of elk use of thermal cover and foraging areas indicates that providing thermal cover does not compensate for inadequate forage conditions (Cook *et al.* 1998). The ratio of cover to forage represents the percentage of the PSU that meets elk requirements for both cover and forage.

Effects of the alternatives on cover and forage are evaluated based on cover/forage ratios for summer and winter range, percent cover for combined MAs 15, 16, 17, and percent thermal cover on winter range in the Silverfish PSU. MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*. The KFP recommends a cover/forage ratio of 30/70 percent for elk winter range (for MA 10 and 11 combined). MAs 10 and 11 were delineated for the KFP and do not entirely overlap with elk winter range mapped by FWP (Figure 87). To avoid confusion with FWP winter range, for impacts evaluated on National Forest System land, winter range is referred to as MAs 10 and 11. Summerfield (1991) recommends 60 percent cover on winter range and summer range combined (for all MAs). On elk winter range, the cover should be at least 40 percent thermal cover (ibid.). Summer range cover may include any combination of hiding and thermal cover (ibid.). The KFP guideline for hiding and thermal cover on MAs 15, 16, and 17 for elk is greater than 15 percent. MAs 15, 16, and 17 are managed for timber production and do not necessarily correspond to areas of seasonal elk use.

Forage Openings

In general, use of foraging areas decreases when big game is required to venture more than 600 feet from cover (Thomas 1979). According to KFP guidelines, maximum opening size on National Forest System lands should generally be less than 40 acres. Summerfield (1991) recommends the same opening size as the grizzly bear (a maximum of 600 feet to cover from any point inside an opening). Forage openings are identified through TSMRS database queries to determine type and age of past harvest. For this analysis, effects of forest openings on elk are evaluated based on the regeneration harvest greater than 40 acres occurring after 1986.

Habitat Effectiveness

The HE of an area refers to the percentage of habitat without open roads that is usable by elk outside of the hunting season. Numerous studies have shown that a strong negative correlation exists between elk use of an area and the density of open roads, even if those roads are only lightly traveled (Frederick 1991). Open road density (ORD) is measured as miles of open roads per square mile (mi/mi^2).

Effects of alternatives on HE are evaluated based on percent HE, ORD for MA 12, and ORD for the combined MA 15, 16, 17, and 18 lands in the Silverfish PSU. The KFP standard for ORD in

MA 12 (managed for big game summer range and timber production) is less than 0.75 mi/mi^2, or greater than 68 percent HE (Lyon 1984). On MAs 15, 16, 17, and 18, the KFP ORD standard is less than 3.0 mi/mi^2, which equates to 38 percent HE. The KFP does not provide ORD standards for winter range (MAs 10 and 11); road use and timber harvest activities would normally be restricted during the winter in these MAs (December 1 to April 30).

Security Habitat

Security habitat offers elk refuge and reduces their vulnerability during the hunting season, and can greatly influence the age structure and composition of a herd. The KFP has no standard for security areas. In 1996, a panel of state and federal wildlife biologists identified security areas as an important component of elk habitat requirements and agreed that it should be quantified based on methods used by Hillis *et al.* (1991) (Johnson 2004a). For this analysis, elk security habitat is defined as areas that are larger than 250 contiguous acres and more than 0.5 mile from an open road, according to Hillis *et al.* (1991).

According to Hillis *et al.* (1991), 30 percent of an elk's fall use area should be maintained as security habitat. Since elk fall use areas could be anywhere within a PSU, the 30 percent minimum elk security standard is applied to all lands within a PSU. Security levels are defined in Appendix H-B of Johnson (2004a).

Key Habitat Features

Moist environments are important to elk, providing high-quality forage, allowing regulation of body temperature, and providing wallowing areas used primarily by bull elk during the breeding season (Lyon *et al.* 1985; Toweill and Thomas 2002). Effects of the alternatives on key habitat features will be evaluated based on the number of wallows, wet meadows, and bogs potentially impacted.

Movement Areas

According to KFP direction, activities such as timber harvest should not interfere with wildlife movement patterns, and forested cover should be provided in harvest and thinning areas as movement corridors for wildlife in summer and winter range. In the KNF, movement corridors along ridgetops are especially important for elk. The analysis of impacts to movement corridors is based on District GIS mapping of topographical contours and is available in the KNF project record.

3.24.3.2.2 Affected Environment

The Silverfish PSU is located in elk HD 104, which is one of six hunting districts in the Lower Clark Fork Elk Management Unit (EMU), described in the Statewide Elk Management Plan (FWP 2004a). The FWP evaluates elk population composition and trends based on total elk, calf/cow ratios, and bull/cow ratios observed during sampling surveys of a portion of the HD referred to as trend areas, harvest data, and hunter effort data (Brown, pers. comm. 2008). The area near the proposed mine facilities is not surveyed during trend surveys, and the most recent trend area survey for HD 104 was conducted in 2003 (FWP 2007a). The average number of elk observed in the trend area for HD 104 from 1999 to 2003 was 193 elk, including an average of 14 bulls (FWP 2004b). Trend area survey goals established by the Statewide Elk Management Plan for HD 104 are between 180 and 270 elk (FWP 2004b). Heavy snowfall during the winter of 1996 to 1997 in northwest Montana resulted in higher than average winter mortality and poor calf production the following spring. In general, all parameters of the elk population in northwest

Montana have increased since the winter of 1996 to 1997 (FWP 2004a). Overall, the elk population in HD 104 has stabilized. Although high snowfall during the winter of 2007 to 2008 resulted in relatively high elk mortality and low calf production, impacts were significantly less than from the winter of 1996 to 1997 (Brown, pers. comm. 2008). The eastern segments of the transmission line alternatives would occur in HD 103, which is in the Salish EMU. An annual average of 152 elk, including 12 bulls, was observed during trend area surveys in HD 103 from 1977 to 2003 (FWP 2004b). Trend area survey goals for HD 103 are 260 elk (FWP 2004b). Some of the larger concentrations of elk in HD 103 occur in the Fisher and Thompson River valleys.

Cover/Forage

As of the end of 2007, elk summer range in the Silverfish PSU is comprised of 99 percent cover and 1 percent forage habitat, while MAs 10 and 11 are comprised of 97 percent cover and 3 percent forage habitat. Cover to forage ratios in the Silverfish PSU indicate that the proportion of forage habitat is well below recommended levels. As noted in the Statewide Elk Management Plan (FWP 2004b), the quality of winter elk forage productivity is declining in the Lower Clark Fork EMU due to conifer encroachment, noxious weed infestations, and aging shrubs. The proportion of thermal cover in winter range is 21 percent, which is below the 40 percent minimum recommended by Summerfield (1991). MAs 15, 16, and 17 in the Silverfish PSU consist of 86 percent thermal and hiding cover combined, which is greater than the recommended 15 percent minimum.

Habitat Effectiveness, Security Habitat, and Open Road Density

Elk security habitat and HE levels are currently greater than desired (57 percent and 76 percent, respectively). Current ORD in the Silverfish PSU is 1.30 mi/mi^2 in MA 12, and 0.8 mi/mi^2 in MAs 15, 16, 17, and 18. ORD for MAs 15, 16, 17, and 18 in the Silverfish PSU meets KFP standards and ORD for MA 12 in the Silverfish PSU does not.

Forage Openings

The Silverfish PSU contains 15 openings greater than 40 acres. The distance to cover may discourage elk from foraging in portions of these openings.

Key Habitat Features

Wetland and riparian areas are described in sections 3.21, *Vegetation* and 3.22, *Wetlands and Other Waters of the U.S.* About 146 acres of wetlands that provide potential wallowing areas for elk occur in the Silverfish PSU.

Movement Areas

Movement corridors along ridgetops are especially important for elk, and most of these areas or travel ways are intact.

Impacts to Elk on State or Private Lands

Elk winter range is shown on Figure 87. The Montanore Project potentially affects elk winter range in the Fisher River and West Fisher Creek corridors and the southern exposures of Miller Creek. The majority of state and private land is heavily roaded and does not provide security habitat for elk (Figure 87).

Following a process developed by Servheen et al. (2003) and the Interagency Grizzly Bear Committee (IGBC) (2001), a wildlife linkage zone has been identified in the Fisher River Valley between the Barren Peak and Teeters Peak areas to the west of U.S. 2 and the Kenelty Mountain and Fritz Mountain areas to the east of U.S. 2 (Figure 87) (see KNF project file for description of linkage zone). A linkage zone is defined as "the area between larger blocks of habitat where animals can live at certain seasons and where they can find the security they need to successfully move between these larger habitat blocks" (IGBC 2001). U.S. 2 in the Fisher River Valley between Raven and Brulee creeks is a crossing area for many species of wildlife, including elk, white-tailed deer, grizzly bear, and moose migrating between summer ranges in the Cabinet Mountains and winter ranges in the Salish Mountains (Brown, pers. comm. 2008). Private land occupies the areas adjacent to U.S. 2 in this linkage area, most of which is heavily roaded and has been logged in the past 20 to 30 years. Regeneration has occurred on some of the logged stands, providing potential hiding cover.

3.24.3.2.3 Environmental Consequences

Impacts to elk habitat and percent elk security, habitat effectiveness, and open road densities in the Silverfish PSU and private and state lands in the analysis area from the various project features of the transmission line alternatives are shown in Table 158 and Table 159, and described in the following subsections. Elk is the MIS for the Silverfish PSU. Impacts associated with the mine alternatives would be limited to the Crazy PSU, where the white-tailed deer is the MIS for general forest species. Impacts to white-tailed deer in the Crazy PSU are described in the *White-tailed Deer* subsection.

Alternative A – No Transmission Line

Alternative A would not impact elk habitat. Forage habitat would decrease over time unless harvest or other events, such as a wildfire or windstorm, created additional forage. Large-scale fires could potentially occur in the Silverfish PSU. Although vegetative succession would reduce forage openings over time, openings created following large fires would likely be relatively large, with long distances between hiding cover. Until hiding cover develops (about 15 to 20 years, depending on site conditions), individual animals may be more vulnerable to predation and hunting mortality in areas where large openings develop following wildfire. Overall, elk populations would probably be maintained.

Table 158. Impacts to Elk Habitat by Transmission Line Alternative.

Habitat Component	[A] No Transmission Line/Existing Conditions	[B] MMC's Proposed Transmission Line (North Miller Creek Alternative)	[C] Modified North Miller Creek Transmission Line Alternative	[D] Miller Creek Transmission Line Alternative	[E] West Fisher Creek Transmission Line Alternative
Silverfish PSU					
Percent Cover/Forage Summer Range[1]	99/1 (60/40)	99/1	99/1	99/1	99/1
Percent Cover/Forage in MAs 10 and 11[2]	97/3(60/40)	96/4	96/4	97/3	95/5
Percent Thermal Cover in MAs 10 and 11[2]	21 (>40)	21	21	21	21
Percent Cover in MAs 15, 16, and 17	86 (>15)	86	86	86	86
# Openings >40 acres[3]	15	16	16	16	16
# Key Habitat Features Affected (acres)[4]	N/A	10	3	13	12
# Movement Areas Affected[5]	N/A	1	2	2	2
All Lands in Analysis Area					
Elk Winter Range Impacted (acres)[6]	0	123	174	149	93

N/A = Does not apply.
Numbers in parentheses represent KFP standards or desired conditions.
[1] Elk summer range includes all MAs except MAs 10 and 11. MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards.*
[2] MAs 10 and 11 are managed for big game winter range; all MA 10 and 11 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23.
[3] Transmission line corridor is counted as 1 opening. No portion of the corridor would be greater than 600 feet to cover.
[4] Key habitat features such as bogs, wallows, and wet meadows are represented by wetlands, as described in section 3.22, *Wetlands and Other Waters of the U.S.*
[5] Movement areas are represented by ridgelines of third order or larger drainages.
[6] Based on 2008 FWP mapping.
Source: GIS analysis by ERO Resources Corp. using KNF data and 2008 FWP mapping.

Table 159. Percent Elk Security, Habitat Effectiveness, and Open Road Densities in the Silverfish PSU During Transmission Line Construction and Operations.

Habitat Component	[A] No Transmission Line/ Existing Conditions	[B] MMC's Proposed Transmission Line (North Miller Creek Alternative)		[C] Modified North Miller Creek Transmission Line Alternative		[D] Miller Creek Transmission Line Alternative		[E] West Fisher Creek Transmission Line Alternative	
		Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]
Percent Security Habitat[3]	57 (>30)	55	57	55	57	55	57	55	57
Habitat Effectiveness[4]	76 (>68)	74	76	74	76	76	76	74	76
ORD in MA 12 (mi/mi^2)[5]	1.30 (≤0.75)	1.40	1.30	1.32	1.30	1.33	1.30	1.70	1.30
ORD in MAs 15, 16, 17, and 18 (mi/mi^2)	0.8 (<3.0)	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8

Numbers in parentheses represent KFP standards or desired conditions.
[1] Const = during mine construction.
[2] Ops = during transmission line operations.
[3] Security habitat is calculated by buffering all roads open during the fall (October 15 to November 30) by 0.5 mile. The remaining area equals the effective habitat. No elk security habitat occurs on private or state land in the analysis area.
[4] Habitat Effectiveness is calculated by buffering all roads open during the summer period (July 1 to October 14) by 0.25 mile. The remaining area within the PSU equals the effective habitat.
[5] All MA 12 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23.
ORD = open road density. MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Cover/Forage

In Alternative B, cover relative to forage habitat would decrease to 96 percent in MAs 10 and 11 in the Silverfish PSU (Table 158). Percent cover relative to forage habitat in summer range; thermal cover in MAs 10 and 11; and percent cover in MAs 15, 16, and 17 in the Silverfish PSU would not change as a result of Alternative B. Alternative B would include the reallocation of MAs 10 and 11 in a 500-foot corridor along the transmission line to MA 23, which does not have a cover/forage standard. All disturbed areas, such as access roads, pulling and tensioning sites, and transmission line clearing areas, would be seeded with grass and shrub species after transmission line construction. Areas where trees were trimmed, but otherwise not disturbed, would be allowed to establish naturally as grassland or shrubland. If revegetation were successful, disturbed areas of winter range would provide additional forage habitat as forage species become established, thereby moving elk habitat conditions in the Silverfish PSU toward KFP objectives. Roads built for the installation of the transmission line would be redisturbed during line reclamation. After the transmission line was removed, all newly constructed roads would be bladed, contoured, and seeded. Once vegetation was re-established, redisturbed areas would provide forage habitat. Current populations of elk would likely be maintained in Alternative B.

Open Road Density, Security Habitat, and Habitat Effectiveness

As described in section 2.4.6.3, *Grizzly Bear Mitigation Plan*, Alternative B includes an access change in NFS road #4724 from April 1 to June 30 to mitigate for impacts to grizzly bears. The seasonal access change in NFS road #4724 is taken into account in ORD and elk security habitat calculations.

During Alternative B line construction, ORD in the Silverfish PSU would increase to 1.40 mi/mi^2 in MA 12, where ORD is currently worse than the KFP standard; and 1.0 mi/mi^2 in MAs 15, 16, 17, and 18, where the KFP standard is met (Table 159). ORD would return to existing conditions during transmission line operations. Alternative B would include the reallocation of MA 12 in a 500-foot corridor along the transmission line to MA 23. The reallocation of MA designations is described in section 3.14, *Land Use*. Because all new or opened roads in MA 12 associated with the Alternative B would be within the 500-foot corridor reallocated as MA 23, a KFP amendment to allow for increased ORD in MA 12 would not be necessary. Alternative B would decrease security habitat by 2 percent during construction, but would remain better than the KFP-recommended minimum. Alternative B would decrease habitat effectiveness to 74 percent, but would remain better than the KFP-recommended minimum. Percent security habitat and habitat effectiveness would return to existing levels during transmission line operations.

Although the new road prism in Alternative B would remain during transmission line operations, roads opened or constructed for transmission line access would be gated or barriered on National Forest System land after transmission line construction. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction. During the final reclamation phase following mine closure, the transmission line would be removed, roads reclaimed, trees along the line allowed to grow, and all disturbed areas revegetated. The increase in ORD and the decrease in security habitat and habitat effectiveness could displace individual elk to less disturbed areas in the short term, until transmission line construction was complete. Overall populations would not likely be affected.

Habitat effectiveness and percent security do not take into account the potential effects of disturbance from helicopter use during line stringing. Helicopter use could contribute to short-term displacement of individual elk from the transmission line corridor. Helicopter use for line stringing would occur during a relatively short period (about 10 days), and overall elk populations would not likely be affected. Except for annual inspection and infrequent maintenance operations, helicopter use and other construction activities would cease after transmission line construction until decommissioning. Helicopter use and other activities could result in short-term disturbance of elk during line decommissioning.

Forage Openings

One opening in forest cover greater than 40 acres would be created by the Alternative B transmission line corridor. No point in the transmission line clearing area would be greater than 600 feet from cover.

Key Habitat Features

The clearing area for Alternative B would include about 10 acres of wetland habitat providing potential wallowing areas for elk; most of the wetlands would be in the Silverfish PSU. Direct effects to wetlands are expected to be mostly avoided by placement and location of transmission line facilities and roads outside of wetlands and waters of the U.S. Less than 0.1 acre of wetlands and waters of the U.S. would be affected by new or upgraded road construction.

Movement Areas

Alternative B could interfere with elk movement in the Silverfish PSU where it followed the ridge between Midas Creek and Howard Creek. Elk could be discouraged from using these areas during transmission line construction due to increased noise from helicopters and machinery and the presence of humans, but these effects would be short-term. The width of clearing area would not likely be great enough to affect elk movement in this area after the construction phase because sufficient cover would be present.

Impacts to Elk on State and Private Lands

Alternative B would affect about 123 acres of elk winter range on all lands in the analysis area, primarily in the Miller Creek drainage (Table 158). Direct impacts to winter range would include a reduction in thermal and hiding cover and, once the transmission line corridor was revegetated, an increase in forage habitat. Short-term disturbance impacts in elk winter range from transmission line construction would be minimized by restricting construction in elk winter range. Alternative B would result in increases in road densities on state and private lands. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction, and could result in a reduction of elk security habitat and increased elk mortality if hunting access were allowed. Short-term habitat displacement could occur in the analysis area during transmission line construction as a result of increased road use and helicopter use. State and private lands currently have high road densities and overall elk populations would not likely be affected.

The eastern segment of the Alternative B transmission line alignment would occur within the wildlife linkage zone in the Fisher River Valley. The proximity of this alignment to U.S. 2 would result in a widening of disturbed area and could potentially discourage elk movement within the linkage zone by decreasing cover. Transmission line construction activities could cause elk to

change their traditional movement patterns within this linkage zone, but these effects would be short-term because human-caused disturbance would cease when the transmission line construction were completed. Once revegetated, cleared areas could provide additional forage habitat. Some shrub and tree cover would be maintained in the transmission line right-of-way because only the largest trees would be removed, and would continue to provide cover. Given that the area of the linkage zone potentially affected by Alternative B is generally heavily roaded and has been logged in the past 20 to 30 years, and given the short-term nature of human-caused disturbance, it is not likely that elk movement within the linkage zone would be greatly affected by Alternative B.

Alternative C – Modified North Miller Creek Transmission Line Alternative

Cover/Forage

The effects of Alternative C on cover-to-forage ratios in the Silverfish PSU would be the same as Alternative B.

Open Road Density, Security Habitat, and Habitat Effectiveness

Alternative C would include access changes (installation of barriers or gates and public access restrictions) in several roads to mitigate for the loss of big game security and impacts to grizzly bear (see Figure 36). These access changes are taken into account in security, habitat effectiveness, and ORD calculations. During Alternative C line construction, ORD in the Silverfish PSU would increase to 1.32 mi/mi^2 in MA 12, where ORD is currently worse than the KFP standard (Table 159). ORD in MAs 15, 16, 17, and 18 in the Silverfish PSU would not change in Alternative C. ORD would return to existing conditions during transmission line operations. Alternative C would include the reallocation of MAs 11 and 12 in a 500-foot corridor along the transmission line to MA 23. The reallocation of MA designations is described in section 3.14, *Land Use*. Because all new or opened roads in MA 12 associated with Alternative C would be within the 500-foot corridor reallocated as MA 23, a KFP amendment to allow for increased ORD in MA 12 would not be necessary. During line construction, Alternative C would result in a decrease in percent security habitat in the Silverfish PSU by 2 percent to 55 percent. Alternative C would decrease habitat effectiveness to 74 percent, but would remain better than the KFP-recommended minimum. Percent security habitat and habitat effectiveness would return to existing levels during transmission line operations.

The status of new or opened roads associated with Alternative C would be the same as Alternative B, except that on National Forest System lands, the status of roads opened or constructed for transmission line access would be changed to intermittent stored service after line installation was completed. Like Alternative B, new roads constructed for Alternative C would remain in the road prism during operations, but would be gated or barriered on National Forest System land after transmission line construction. In Alternative C, new transmission line roads on National Forest System lands would be decommissioned and revegetated after closure of the mine and removal of transmission line. The increase in road use and the decrease in security habitat could displace individual elk to less disturbed areas in the short term, until transmission line construction was complete. Overall populations would not likely be affected.

Habitat effectiveness and percent security do not take into account the potential effects of disturbance from helicopter construction. Helicopter use could contribute to short-term displacement of individual elk from the transmission line corridor, but overall elk populations would not likely be affected. Helicopter line stringing would occur during a relatively short

period (about 10 days). Helicopters also would be used for vegetation clearing and structure construction in some segments, and the resulting disturbance could last up to 2 months. Except for annual inspection and infrequent maintenance operations, helicopter use and other construction activities would cease after transmission line construction until decommissioning. Helicopters use and other activities could result in short-term disturbance of elk during line decommissioning.

Forage Openings

New forage openings would be the same for Alternative C as Alternative B.

Key Habitat Features

The clearing area for Alternative C would include about 3 acres of wetland habitat providing potential wallowing areas for elk; most of the impacted wetlands would be in the Silverfish PSU. Direct effects to wetlands are expected to be mostly avoided by placement and location of transmission line facilities and roads outside of wetlands and waters of the U.S.

Movement Areas

Alternative C may interfere with elk movement where it followed the ridge between Midas Creek and Howard Creek and the east-facing ridge north of the Sedlak Park Substation. Elk could be discouraged from using these areas during transmission line construction due to increased noise from helicopters and machinery and the presence of humans, but these effects would be short-term. The width of clearing area would not likely be great enough to affect elk movement in this area after the construction phase because sufficient cover would be present.

Impacts to Elk on State and Private Lands

Alternative C would affect about 174 acres of elk winter range on all lands in the analysis area, primarily in the Miller Creek and Fisher River drainages (Table 158). Direct impacts to winter range would include a reduction in thermal and hiding cover and, once the transmission line corridor was revegetated, an increase in forage habitat. Short-term disturbance impacts in elk winter range from transmission line construction would be minimized by restricting construction during the winter. Alternative C would result in increases in road densities on state and private lands. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction, and could result in a reduction of elk security habitat and increased elk mortality if hunting access were allowed. Short-term habitat displacement could occur in the analysis area during transmission line construction as a result of increased road use and helicopter use. State and private lands currently have high road densities and overall elk populations would not likely be affected.

A relatively small segment of the Alternative C transmission line would cross the Fisher River Valley in the wildlife linkage zone, potentially discouraging elk movement in a localized area due to transmission line construction activities. These effects would be short-term because human-caused disturbance would cease when the transmission line construction was completed. The segment of Alternative C that would parallel U.S. 2 would be located upslope and out of the Fisher River Valley, and would not likely affect elk movement in the linkage zone. Given that the area of the linkage zone potentially affected by Alternative C is generally heavily roaded and has been logged in the past 20 to 30 years, and given the short-term nature of human-caused

disturbance, it is not likely that this alternative would greatly affect elk movement within the linkage zone.

Alternative D – Miller Creek Transmission Line Alternative

Cover/Forage

Alternative D would not change the proportion of cover relative to forage habitat in summer range, MAs 10 and 11, or MAs 15, 16, 17, and 18 from existing conditions in the Silverfish PSU.

Open Road Density, Security Habitat, and Habitat Effectiveness

Alternative D would include the same road access changes described for Alternative C. The status, use, and reclamation of new or opened roads associated with the transmission line would be the same as Alternative C.

Alternative D impacts on ORD, percent security habitat, and habitat effectiveness would be the same as Alternative C except that ORD in MA 12 in the Silverfish PSU would increase to 1.33 during Alternative D construction (Table 159). MA 12 would be reallocated to MA 23, and a KFP amendment to allow for increased ORD in MA 12 would not be necessary.

The impacts of helicopter construction and stringing the transmission line would be the same for Alternative D as Alternative C.

Forage Openings

New forage openings would be the same for Alternative D as Alternative B.

Key Habitat Features

The clearing area for Alternative D would include about 13 acres of wetland habitat providing potential wallowing areas for elk; most of the impacted wetlands would be in the Silverfish PSU. Direct effects to wetlands are expected to be mostly avoided by placement and location of transmission line facilities and roads outside of wetlands and waters of the U.S.

Movement Areas

Alternative D could interfere with elk movement where it followed the east-facing ridge north of the Sedlak Park Substation and crosses the ridge between Miller Creek and Howard Creek. Elk could be discouraged from using these areas during transmission line construction due to increased noise from helicopters and machinery and the presence of humans, but these effects would be short-term. The width of clearing area would not likely be great enough to affect elk movement in this area after the construction phase because sufficient cover would be present.

Impacts to Elk on State and Private Lands

Impacts of Alternative D on elk winter range would be similar to Alternative C except that Alternative D would affect about 149 acres of elk winter range on all lands in the analysis area, primarily in the Miller Creek and Fisher River drainages (Table 158). Impacts of Alternative D on elk in the wildlife linkage zone in the Fisher River Valley would be the same as Alternative C.

Alternative E – West Fisher Creek Transmission Line Alternative

Cover/Forage

The effects of Alternative E on cover-to-forage ratios in the Silverfish PSU would be the same as Alternatives C and D except that Alternative E would decrease cover relative to forage habitat in MAs 10 and 11 to 95 percent in the Silverfish PSU. MAs 10 and 11 would be reallocated to MA 23, which does not have a cover/forage standard.

Open Road Density, Security Habitat, and Habitat Effectiveness

Alternative E would include the same changes in road access described for Alternative C. The status, use, and reclamation of new or opened roads associated with the transmission line would be the same for Alternative E as Alternative C.

Alternative E impacts on ORD and percent security habitat would be the same as Alternative D except that ORD in MA 12 in the Silverfish PSU would increase to 1.7 mi/mi^2 during construction of Alternative E (Table 159). Alternative E would include the same access changes described for Alternative C. The impacts of helicopter construction and stringing the transmission line would be the same for Alternative E as Alternative C.

Forage Openings

New forage openings would be the same for Alternative E as Alternative B.

Key Habitat Features

The clearing area for Alternative E would include about 12 acres of wetland habitat providing potential wallowing areas for elk; most of the impacted wetlands would be in the Silverfish PSU. Direct effects to wetlands are expected to be mostly avoided by placement and location of transmission line facilities and roads outside of wetlands and waters of the U.S.

Movement Areas

Alternative E could interfere with elk movement where it followed the east-facing ridge north of the Sedlak Park Substation and crossed the ridge between West Fisher and Howard creeks. Elk could be discouraged from using these areas during transmission line construction due to increased noise from helicopters and machinery and the presence of humans, but these effects would be short-term. The width of clearing area would not likely be great enough to affect elk movement in this area after the construction phase because sufficient cover would be present.

Impacts to Elk on State and Private Lands

Of all the transmission line alternatives, Alternative E would affect the least amount of elk winter range (about 93 acres) on all lands in the analysis area, primarily in the Fisher River and West Fisher Creek drainages. Otherwise, impacts of Alternative E on elk winter range would be the same as Alternative C. Impacts of Alternative E on elk in the wildlife linkage zone in the Fisher River Valley would be the same as Alternative C.

Combined Mine-Transmission Line Effects

Impacts to elk habitat in the analysis area from combined mine-transmission line alternatives are described below and shown in Table 160.

Cover/Forage

The combined mine-transmission line alternatives would not change the percent cover to forage in summer range; the percent of thermal cover in MAs 10 and 11; or the percent cover in MAs 15, 16, and 17. All alternatives would result in small decreases in cover relative to forage habitat in MAs 10 and 11. All transmission line alternatives would include the reallocation of MAs 10 and 11 in a 500-foot corridor along the transmission line to MA 23, which does not have a cover/forage standard. Alternatives 3E and 4E would result in the greatest reductions in cover and increases in forage habitat. Alternatives 3D and 4D would have the least impact on cover-to-forage ratios.

Open Road Density, Security Habitat, and Habitat Effectiveness

As described in sections 2.4.6.3, *Grizzly Bear Mitigation Plan* and 2.5.7.3, *Wildlife Mitigation*, Alternative B includes an access change in NFS road #4724 from April 1 to June 30 to mitigate for impacts to grizzly bears and the agencies' alternatives would include access changes (installation of barriers or gates and public access restrictions) in several roads to mitigate for the loss of big game security and impacts to grizzly bear. These access changes are taken into account in security, habitat effectiveness, and ORD calculations.

In all action alternatives, the new road prism would remain during transmission line operations. Roads opened or constructed for transmission line access would be gated or barriered on National Forest System land after transmission line construction. In the agencies' alternatives, roads would be placed into intermittent stored service after line installation was completed. Intermittent stored service roads would be closed to traffic and would be treated so they would cause little resource risk if maintenance were not performed during the operation period of the mine and prior to their future need. The service roads would not be used for routine maintenance of the transmission line, but could be used for emergency repairs, such as a damaged insulator. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction. During the final reclamation phase following mine closure, the transmission line would be removed, roads reclaimed, and all disturbed areas revegetated. In the agencies' alternatives, roads would be decommissioned at mine closure and transmission line decommissioning.

Habitat effectiveness and percent security do not take into account the potential effects of disturbance from helicopters. Disturbance from helicopter use and other transmission line construction activities are described for Alternatives B and C above.

None of the agencies' alternatives would change ORD in MAs 15, 16, 17, and 18, while Alternative 2B would result in a slight increase in ORD in MAs 15, 16, 17, and 18 during transmission line construction (Table 161). During transmission line construction, all action alternatives would increase ORD in MA 12, where ORD is currently better than the KFP standard.

Table 160. Impacts to Elk Habitat in the Analysis Area by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] No Mine Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Alternative		
	TL-A	TL-B	TL-C	TL-D	TL-E	TL-C	TL-D	TL-E
Silverfish PSU								
Percent Cover/forage Summer Range[1]	99/1 (60/40)	99/1	99/1	99/1	99/1	99/1	99/1	99/1
Percent Cover/forage in MAs 10 and 11[2]	97/3(60/40)	96/4	96/4	97/3	95/5	96/4	97/3	95/5
Percent Thermal Cover in MAs 10 and 11[2]	21 (>40)	21	21	21	21	21	21	21
Percent Cover in MAs 15, 16, and 17	86 (>14)	86	86	86	86	86	86	86
# Openings >40 acres[3]	15	16	16	16	16	16	16	16
Key Habitat Features Affected (acres)[4]	N/A	10	3	13	12	3	13	12
# Movement Areas Affected[5]	N/A	1	2	2	2	2	2	2
All Lands in Analysis Area								
Elk Winter Range Impacted (acres)[6]	0	123	174	149	93	174	149	93

N/A = Does not apply.
Numbers in parentheses represent KFP standards or desired conditions.
Impacts shown are for the transmission line construction phase, which represents maximum estimated impacts.
[1] Elk summer range includes all MAs except MAs 10 and 11. MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*.
[2] MAs 10 and 11 are managed for big game winter range; all MAs 10 and 11 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23.
[3] Transmission line corridor is counted as one opening. Other than the corridor length, no portion of the corridor would be greater than 600 feet to cover.
[4] Key habitat features, such as bogs, wallows, and wet meadows, are represented by wetlands, as described in section 3.22, *Wetlands and Other Waters of the U.S.*
[5] Movement areas are represented by ridgelines of third order or larger drainages.
[6] Based on 2008 FWP mapping.
Source: GIS analysis by ERO Resources Corp. using KNF data and 2008 FWP mapping.

Table 161. Percent Elk Security, Habitat Effectiveness, and Open Road Densities in the Silverfish PSU by Combined Mine and Transmission Line Alternatives.

Measurement Criteria	[1] No Mine Existing Condition	[2] MMC's Proposed Mine		[3] Agency Mitigated Poorman Impoundment Alternative						[4] Agency Mitigated Little Cherry Creek Impoundment Alternative					
		TL-B		TL-C		TL-D		TL-E		TL-C		TL-D		TL-E	
		Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]
Percent Security Habitat[3]	57 (>30)	55	57	55	57	57	57	57	57	55	57	57	57	57	57
Habitat Effectiveness[4]	76 (>68)	74	76	74	76	76	76	74	76	74	76	76	76	74	76
ORD in MA 12 (mi/mi^2)[5]	1.30 ($\leq$0.75)	1.40	1.30	1.32	1.30	1.33	1.30	1.70	1.30	1.32	1.30	1.33	1.30	1.70	1.30
ORD in MAs 15, 16, 17, and 18 (mi/mi^2)	0.8 (<3.0)	1.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8

Numbers in parentheses represent KFP standards or desired conditions.
[1] Const = during mine construction.
[2] Ops = during transmission line operations.
[3] Security habitat is calculated by buffering all roads open during the fall (October 15 to November 30) by 0.5 mile. The remaining area equals the effective habitat. No elk security habitat occurs on private or state land in the analysis area.
[4] Habitat Effectiveness is calculated by buffering all roads open during the summer period (July 1 to October 14) by 0.25 mile. The remaining area within the PSU equals the effective habitat.
[5] All MA 12 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23.
ORD = open road density. MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*.
Source: GIS analysis by ERO Resources Corp. using KNF data.

In all action alternatives, ORD would return to existing densities during transmission line operations. All transmission line alternatives would include the reallocation of MA 12 in a 500-foot corridor along the transmission line to MA 23. The reallocation of MA designations is described in section 3.14, *Land Use*. Because all new or opened roads in MA 12 associated with the combined action alternatives would be within the 500-foot corridor reallocated as MA 23, a KFP amendment to allow for increased ORD in MA 12 would not be necessary for these alternatives.

Alternatives 2B, 3C, and 4C would result in a 2 percent reduction in elk security habitat during transmission line construction. Percent elk security habitat would return to existing levels following transmission line construction. Alternatives 3D, 3E, 4D, and 4E would not change percent security habitat.

Alternatives 2B, 3C, 3E, 4C, and 4E would result in a 2 percent decrease in habitat effectiveness in the Silverfish PSU. Following transmission line construction, habitat effectiveness would return to existing levels. None of the other combined mine-transmission line alternatives would affect habitat effectiveness in the Silverfish PSU.

Increases in ORD and the decrease in security habitat and habitat effectiveness could displace individual elk to less disturbed areas in the short term, until transmission line construction was complete. Overall populations would not likely be affected.

Overall, road densities, percent security habitat, and habitat effectiveness would likely improve through MMC's or the agencies' grizzly bear land acquisition program. Acquired parcels would be managed for grizzly bear use in perpetuity, and could improve road densities, percent security habitat, and habitat effectiveness where roads could be closed. The agencies' land acquisition program would likely be more effective at reducing road densities than MMC's proposed land acquisition program because more land would be protected.

Forage Openings

In all combined action alternatives, one opening greater than 40 acres would be created. No point in this opening created by the transmission line clearing area would be greater than 600 feet from cover.

Key Habitat Features

Alternatives 3C and 4C would have the least impacts on wetland habitat providing potential wallowing areas for elk in the Silverfish PSU. Impacts of the other combined action alternatives on wetlands would be comparable, ranging from 10 acres for Alternative 2B to 13 acres for Alternatives 3D and 4D. Direct effects to wetlands are expected to be mostly avoided by placement and location of transmission line facilities and roads outside of wetlands and waters of the U.S.

Movement Areas

The agencies' alternatives may interfere with elk movement where it followed the east-facing ridge north of the Sedlak Park Substation. Alternative 2B would be located at a lower elevation in the Fisher River Valley and would not impact this area. Alternatives 2B, 3C, and 4C may interfere with elk movement where the transmission lines followed the ridge between Midas Creek and Howard Creek. Potential elk movement along the ridge between Miller Creek and Howard Creek

could be affected by Alternatives 4C and 4D. Elk could be discouraged from using these areas during transmission line construction due to increased noise from helicopters and machinery and the presence of humans, but these effects would be short-term. The width of clearing area would not likely be great enough to affect elk movement in this area after the construction phase because sufficient cover would be present.

Elk Winter Range on All Lands

Impacts to elk winter range from the combined action alternatives on all lands in the analysis area, including private and state lands, would range between 93 acres and 173 acres. Alternatives 3C and 3D would have the greatest impacts to winter range, while Alternatives 3D and 3E would have the fewest impacts to winter range. In all combined action alternatives, direct impacts to winter range would include a reduction in thermal and hiding cover and, once the transmission line corridor was revegetated, an increase in forage habitat. Short-term disturbance impacts in elk winter range from transmission line construction would be minimized by restricting construction during the winter. All combined action alternatives would result in increased road densities on state and private lands. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction, and could result in a reduction of elk security habitat and increased elk mortality if hunting access were allowed. Short-term habitat displacement could occur in the analysis area during transmission line construction as a result of increased road use and helicopter use. State and private lands currently have high road densities and overall elk populations would not likely be affected.

Wildlife Linkage Zone

The eastern segment of the Alternative 2B transmission line corridor would occur within the wildlife linkage zone in the Fisher River Valley and relatively small segments of all combined action alternatives would cross the Fisher River Valley in the wildlife linkage zone. The portions of the combined agencies' alternative transmission lines that would parallel U.S. 2 would be located upslope and out of the Fisher River Valley, and would not likely affect elk movement in the linkage zone. Impacts of the combined action alternatives on elk in the Fisher River Valley wildlife linkage zone are the same as described for transmission line Alternatives B, C, D, and E above.

Cumulative Effects

Roads constructed in association with timber harvest, mining, and other development have cumulatively reduced elk security habitat and habitat effectiveness in the analysis area. Development of private lands within the analysis area, including commercial timber harvest, land clearing, home construction, and road construction has contributed to increased disturbance of elk and a loss or reduction in quality of foraging and winter habitat, and is expected to continue. Fire suppression has resulted in the encroachment of conifers into foraging habitat and aging of shrub habitat.

The Miller-West Fisher Vegetation Management Project would occur entirely in the Silverfish PSU and would include regeneration harvest of about 475 acres, slash treatment of 681 acres, and prescribed burning of 3,751 acres of National Forest System lands in the Silverfish PSU. Because of the availability of harvest data, the effects of the Miller-West Fisher Vegetation Management Project can be evaluated quantitatively for cover and forage. Surface impacts from other reasonably foreseeable actions in the Silverfish PSU would be minimal, and would not result in any measurable changes in cover or forage habitat. Cumulative impacts of the Miller-West Fisher

Vegetation Management Project, in combination with the Montanore action alternatives, on cover-to-forage ratios are shown in Table 162. The transmission line action alternatives would not change the percent cover to forage in summer range; the percent of thermal cover in winter range; or the percent cover in MAs 15, 16, and 17; and would not contribute to cumulative changes in these parameters. the transmission line alternatives are not evaluated for cumulative effects on elk.

New roads and access changes for mitigation associated with reasonably foreseeable actions, including the Wayup Mine/Fourth of July Road Access Project, Plum Creek activities, and the Miller-West Fisher Vegetation Management Project, will contribute to cumulative effects on ORD. The No Action alternatives (Alternative 1 and Alternative A) would not contribute to cumulative impacts on elk. Cumulative impacts of the combined mine-transmission line alternatives, in combination with other reasonably foreseeable actions, on percent elk security habitat, habitat effectiveness, and ORD are shown in Table 162. The mine alternatives would not have any effects on elk in the Silverfish PSU, and would not contribute to cumulative effects.

Cover/Forage

All action alternatives, except Alternatives 3D and 4D, in combination with the Miller-West Fisher Vegetation Management Project, would result in cumulative increases in forage habitat relative to cover in MAs 10 and 11. MAs 10 and 11 would be reallocated to MA 23, which does not have a cover/forage standard. Habitat clearing and forest treatments associated with these projects would provide more forage habitat, which would improve overall habitat conditions in elk hunting districts (HD) 103 and 104 and the KNF. Given the existing levels of cover, cumulative effects on cover and forage habitat are not likely to effect elk populations in elk HD number 104 or the KNF.

Open Road Density, Security Habitat, and Habitat Effectiveness

Access changes resulting from Wayup Mine/Fourth of July Road Access Project, Plum Creek activities, the Miller-West Fisher Vegetation Management Project, and other reasonably foreseeable actions would increase ORD to 1.77 mi/mi^2 in MA 12 and 1.1 mi/mi^2 in MAs 15, 16, 17, and 18. Alternative 2B would increase ORD in MAs 15, 16, 17, and 18 to 1.2 mi/mi^2. In MA 12, Alternatives 2B, 3E, and 4E would increase ORD to 1.85 mi/mi^2, while Alternatives 3D and 4D would increase ORD to 1.80 mi/mi^2. ORD would return to existing conditions during transmission line operations.

Security habitat would be reduced by 10 percent and habitat effectiveness would be reduced by 19 percent as a result of cumulative impacts of the Wayup Mine/Fourth of July Road Access Project, Plum Creek activities, the Miller-West Fisher Vegetation Management Project, and other reasonably foreseeable actions, but the contribution of the Montanore action alternatives to changes in percent security habitat and habitat effectiveness would not be measurable.

Forage Openings

The combined mine-transmission line alternatives would not create any new openings greater than 40 acres with points greater than 600 feet from cover in the Silverfish PSU, and would not contribute to cumulative increases in forest openings that elk might avoid.

Table 162. Cumulative Impacts to Elk Habitat in the Silverfish PSU by Combined Mine-Transmission Line Alternative.

Measurement Criteria	Existing Conditions	[1] No Mine[1]	[2] MMC's Proposed Mine		[3] Agency Mitigated Poorman Impoundment Alternative						[4] Agency Mitigated Little Cherry Creek Impoundment Alternative					
			TL-B		TL-C		TL-D		TL-E		TL-C		TL-D		TL-E	
			Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]
Percent Cover/forage in MAs 10 and 11[4]	97/3 (60/40)	92/8 (60/40)	91/9	91/9	91/9	91/9	92/8	92/8	90/10	90/10	91/9	91/9	92/8	92/8	90/10	90/10
Percent Security Habitat[5]	57 (>30)	47 (>30)	47	47	47	47	47	47	47	47	47	47	47	47	47	47
Habitat Effectiveness[6]	76 (>68)	57 (>68)	57	57	57	57	57	57	57	57	57	57	57	57	57	57
ORD in MA 12 (mi/mi^2)[7]	1.30 ($\leq$0.75)	1.77 ($\leq$0.75)	1.85	1.77	1.77	1.77	1.80	1.77	1.85	1.77	1.77	1.77	1.80	1.77	1.85	1.77
ORD in MAs 15, 16, 17, and 18 (mi/mi^2)	0.8 (<3.0)	1.1 (<3.0)	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1

Numbers in parentheses represent KFP standards or desired conditions.

[1] Effects shown include effects of the Wayup Mine/Fourth of July Road Access Project, Plum Creek activities, the Rock Creek Project, and the Miller-West Fisher Vegetation Management Project. Alternative 1 (No Transmission Line) would not contribute to cumulative effects on ORD.

[2] Const = during mine construction.

[3] Ops = during transmission line operations.

[4] MAs 10 and 11 are managed for big game winter range; all MA 10 and 11 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23. MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*.

[5] Security habitat is calculated by buffering all roads open during the fall (October 15 to November 30) by 0.5 mile. The remaining area equals the effective habitat. No elk security habitat occurs on private or state land in the analysis area.

[6] HE is calculated by buffering all roads open during the summer period (July 1 to October 14) by 0.25 mile. The remaining area within the PSU equals the effective habitat.

[7] All MA 12 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23.

ORD = open road density.

Source: GIS analysis by ERO Resources Corp. using KNF data.

Key Habitat Features

All combined action alternatives would result in the disturbance of wetlands providing potential wallowing habitat for elk in the Silverfish PSU. The clearing area for the combined action alternatives would include between 3 and 13 acres of wetlands. Other reasonably foreseeable actions would contribute to losses of wetland habitat; unavoidable impacts to wetlands in all reasonably foreseeable actions would require compensatory mitigation under the Clean Water Act.

Movement Areas

All combined action alternatives may interfere with elk movement where ridges and drainages were crossed. Disturbance-related impacts would be short-term, and the width of clearing area would not likely be great enough to affect elk movement after the construction phase because sufficient cover would be present. Other reasonably foreseeable actions could impede elk movement in specific areas, but KNF riparian standards would minimize activities in riparian areas, and activities on ridgelines would generally be avoided due to steep terrain. While some cumulative effects to elk movement could occur, they would likely to be minimal.

Elk Winter Range on All Lands

All combined action alternatives, in combination with other reasonably foreseeable actions, especially the Miller-West Fisher Vegetation Management Project, would result in cumulative impacts to elk winter range on all lands in the analysis area, resulting in a reduction of thermal and hiding cover and, once disturbed areas were revegetated, an increase in forage habitat. Cumulative impacts of all combined action alternatives would be minor due to construction timing restrictions in elk winter range. The combined action alternatives, in combination with Plum Creek activities, would result in cumulative disturbance to elk on private lands in the analysis area, and could displace of elk away from areas of disturbance. Private lands are generally heavily roaded and elk in these areas may be habituated to higher levels of disturbance than on National Forest System lands.

3.24.3.2.4 Regulatory/Forest Plan Consistency

KFP. All of the combined agencies' alternatives would meet KFP direction for general forest MIS species (KFP Vol. 1, II-22 #3, III-45 #8 and III-49 #7).

During transmission line construction, all action alternatives would increase ORD in areas currently managed as MA 12 in the Silverfish PSU. All action alternatives would include a project-specific amendment to the KFP to change MA 12 within a 500-foot corridor designated for the transmission line corridor to MA 23. The amendment would be for the duration of the proposed Montanore Project. KFP amendments have been discussed section 3.14.4, *Environmental Consequences* in the *Land Use* section. All new or opened roads in MA 12 associated with the transmission line would be within the 500-foot corridor reallocated as MA 23.

State Elk Plan. The analysis area is located in the Lower Clark Fork and Salish Elk Management Units identified in the FWP Statewide Elk Management Plan. None of the combined action alternatives are consistent with that document because they would result in short-term decreases in elk security habitat.

Summary General Forest MIS Statement. Based on the elk analysis and the KNF Conservation Plan (Johnson 2004a), all combined mine-transmission line action alternatives should provide

general forest species habitat with sufficient quality and quantity of the diverse age classes of vegetation needed for viable populations. In all combined mine-transmission line alternatives, sufficient general forest habitat should be available; the populations of species using that habitat should remain viable.

3.24.3.3 White-tailed Deer

3.24.3.3.1 Analysis Area and Methods

White-tailed deer population ecology, biology, habitat description, and relationships identified by research are described in Baty (1995), Mundinger (1981), Morgan (1993), Lyon (1966), Thomas (1979), and Mackie *et al.* (1998).

PSUs are sufficiently large enough to address potential effects of the alternatives on white-tailed deer populations at a landscape level. The analysis area for evaluating direct and indirect project impacts to individuals and their habitat in the KNF is the Crazy PSU (Figure 87). The analysis area for determining direct and indirect effects on white-tailed deer is HD 104 and the KNF. The analysis area for determining cumulative effects on white-tailed deer is the KNF. To evaluate potential direct and indirect impacts of the transmission line on white-tailed deer on private and state land, the analysis area includes all non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments. The Crazy PSU and any non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments is the analysis area for cumulative effects on individual white-tailed deer and their habitat.

Population information is based on HD data provided by FWP. Indicators used to assess effects on white-tailed deer in the KNF are cover/forage ratios, forage openings, ORD, movement areas, and key habitat features affected. Data sources used in this analysis include FWP hunting and population data, research, and plans; District vegetation layers; INFRA roads layers; TSMRS data; Summerfield (1991); and field surveys by District biologists and data collection crews.

As described in sections 2.4.6.3, *Grizzly Bear Mitigation Plan* and 2.5.7.3, *Wildlife Mitigation*, MMC's proposed Alternatives 2 and B include an access change in NFS road #4724 from April 1 to June 30 and the yearlong access change in a segment of NFS road #4784 to mitigate for impacts to grizzly bears. NFS road #4784 is proposed for access change by the Rock Creek Project, and is no longer available for Montanore Mine mitigation. The agencies' alternatives would include yearlong access changes through the installation of barriers or gates on several roads to mitigate for the loss of big game security and impacts to grizzly bear. These road access changes are taken into account in ORD calculations. Additional road access changes also would occur on land acquired as part of the grizzly bear mitigation proposed by MMC and the agencies. ORD calculations do not take into account the effect of land acquisition programs proposed by MMC and the agencies. Other mitigation measures incorporated into MMC's or the agencies' alternatives that could benefit white-tailed deer include winter construction timing restrictions in white-tailed deer winter range, prohibiting employees from carrying firearms, busing employees to the work site, and monitoring road-killed animals along mine access roads to determine if improved access resulted in increased wildlife mortality.

Impacts to white-tailed deer on private and state land from the transmission line alternatives were evaluated based on FWP winter habitat mapping; (Figure 87); FWP hunting and population data,

research, and plans; KNF and FWP information on wildlife linkage areas; and mapping of broad vegetation types shown on Figure 83.

Cover/Forage Ratios

Cover and forage are defined in section 3.24.3.2, *Elk*. Effects of the alternatives are evaluated based on cover/forage ratios for summer and winter range; percent cover for combined MAs 15, 16, and 17; and percent thermal cover on winter range (MAs 10 and 11) in the Crazy PSU. MAs 10 and 11 were delineated for the KFP and do not entirely overlap with white-tailed deer winter range mapped by FWP (Figure 87). MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*. To avoid confusion with FWP winter range, for impacts evaluated on National Forest System land, winter range is referred to as MAs 10 and 11. The KFP recommends a cover/forage ratio for white-tailed deer of 70 percent to 30 percent for MAs 10 and 11 combined. Summerfield (1991) recommends a cover of 70 percent on winter and 60 percent on summer range (for all MAs not managed for deer winter range). On white-tailed deer winter range, the cover should be at least 50 percent thermal cover (Id.). Summer range cover may be in any combination of hiding and thermal cover (Id.). The KFP guideline for hiding and thermal cover on MAs 15, 16, and 17 combined for white-tail deer is greater than 30 percent. MAs 15, 16, and 17 are managed for timber production and do not necessarily correspond to areas of seasonal white-tailed deer use.

Open Road Densities

Effects of roads on white-tailed deer are not well documented. White-tailed deer are more secretive and have smaller home ranges than elk, and may be less likely to avoid roads than elk (Lyon 1979), especially where cover is dense. Roads may increase white-tailed deer vulnerability to hunting season mortality by facilitating hunter access and eliminating refugia (Idaho Department of Fish and Game 2004). KFP standards for ORD are the same for white-tailed deer as described for elk.

Forage Openings

For white-tailed deer, the KFP recommends avoiding the creation of openings greater than 20 acres between areas of cover in MAs 11 and 12. MA 12 is managed to enhance big game non-winter habitat. In MA 10, timber is generally only harvested to maintain or enhance big game winter range, and opening size is minimized. Summerfield (1991) recommends that the opening size be the same as the standard for grizzly bear (a maximum of 600 feet to cover from any point inside an opening). TSMRS forage openings are identified through TSMRS database queries to determine type and age of past harvest. For this analysis, effects of forest openings on deer are evaluated based on the regeneration harvest greater than 20 acres occurring after 1986.

Movement Areas

For white-tailed deer, the corridor of thermal cover between openings that do not provide thermal cover in winter range should be at least 600 feet wide or as wide as the opening, whichever is greater (Summerfield 1991). In the KNF, movement corridors along riparian areas and ridges are especially important for white-tailed deer. The analysis of impacts to movement corridors is based on District GIS mapping of thermal cover in winter range and riparian areas and is available in the KNF project record.

Key Habitat Features

Moist environments are important to white-tailed deer, especially in late summer to early fall, providing water and high-quality forage and allowing regulation of body temperature (Idaho Department of Fish and Game 2004). Effects of the alternatives on key habitat features will be evaluated based on the number of wet meadows and bogs potentially impacted.

3.24.3.3.2 Affected Environment

White-tailed deer are the most abundant and widespread big game animal in the KNF (USDA Forest Service 2005c). The Crazy PSU is within HD 104. The eastern portions of the transmission line alternatives would occur in HD 103. The FWP evaluates deer population composition and trends based on total deer, fawn/doe ratios, and buck/doe ratios observed during sampling surveys of a portion of the HD referred to as trend areas, harvest data, and hunter effort data (Brown, pers. comm. 2008). Heavy snowfall during the winter of 1996 to 1997 in northwest Montana resulted in higher than average winter mortality and poor fawn production the following spring. In general, white-tailed deer populations in northwest Montana have increased since the winter of 1996 to 1997 (FWP 2008b). Overall, the white-tailed deer populations in HDs 103 and 104 have stabilized. High snowfall during the winter of 2007 to 2008 resulted in relatively high winter mortality and low fawn production, resulting in the lowest observed ratio of fawns to adults in northwest Montana since 1998 (FWP 2008b).

Cover/Forage

Currently, white-tailed deer summer range in the Crazy PSU is comprised of 96 percent cover and 4 percent forage habitat, while MAs 10 and 11 are comprised of 83 percent cover and 17 percent forage habitat (Figure 87). The proportion of thermal cover in MAs 10 and 11 is 10 percent. In comparison to the 50 percent minimum recommended by Summerfield (1991), thermal cover is not adequately provided in the Crazy PSU. MAs 15, 16, and 17 in the Crazy PSU consist of 85 percent thermal and hiding cover combined, which is greater than the recommended 30 percent minimum. MAs 15, 16, 17, and 18 have a limited distribution in the Crazy PSU. Cover to forage ratios in the Crazy PSU indicate that while cover is abundant, thermal cover and forage habitat may be lacking in the Crazy PSU. Forage habitat is underestimated because white-tailed deer will forage underneath forest canopies and in harvested areas currently mapped as cover. Most forage habitat occurs in lower elevation areas of the Little Cherry Creek drainage and the mouths of its tributaries, or in isolated patches of past disturbance. Overall forage habitat in the Crazy PSU is well distributed.

Open Road Density

The Crazy PSU contains 93 acres of allocated summer range (MA 12). Current ORD in the Crazy PSU are 4.91 mi/mi^2 in MA 12, and 4.9 mi/mi^2 in MAs 15, 16, 17, and 18. Road density standards are not met for either MA 12 or MAs 15, 16, 17, and 18. ORD worse than the standard may increase mortality during hunting season by facilitating hunter access.

Forage Openings

Recently, created forage openings in MAs 11 and 12 range from less than 1 acre to 320 acres. The Crazy PSU contains six openings greater than 20 acres in MAs 11 and 12. Of the six openings, five have points greater than 600 feet from cover. The distance to cover may discourage white-tailed deer from foraging in these openings.

Movement Areas

Movement corridors along drainage bottoms and ridgetops are especially important for many wildlife species; most of these areas or travel ways are intact. Portions of private land along Libby Creek may lack suitable cover, especially where timber harvests have occurred, affecting the ability of some species to move freely or securely through these areas.

Key Habitat Features

Wetland and riparian areas are described in sections 3.21, *Vegetation* and 3.22, *Wetlands and Other Waters of the U.S.* About 172 acres of wetlands occur in the Crazy PSU.

Impacts to White-tailed Deer on State or Private Lands

As shown on Figure 87, only a small portion of white-tailed deer winter range occurs in the Crazy PSU, along the lower reaches of Bear Creek. White-tailed deer winter range potentially affected by the transmission line alternatives occurs in the Fisher, West Fisher, and Miller creek corridors. The majority of state and private lands has been harvested for timber and currently has high road densities.

A wildlife linkage zone important to white-tailed deer has been identified in the Fisher River Valley between the Barren Peak and Teeters Peak areas to the west of U.S. 2 and the Kenelty Mountain and Fritz Mountain areas to the east of U.S. 2 (see KNF project record). A detailed description of this wildlife linkage zone is provided in the elk analysis.

3.24.3.3.3 Environmental Consequences

The white-tailed deer is the MIS for the Crazy PSU. Impacts to white-tailed deer habitat and open road densities in the Crazy PSU and private and state lands in the analysis area from the various project features of the combined mine-transmission line alternatives are shown in Table 163, Table 164, and Table 165, and are described in the following subsections.

Alternative 1 – No Mine

Impacts to white-tailed deer habitat from the mine alternatives are shown in Table 163. Alternative 1 would not have direct or indirect impacts on white-tailed deer or their habitat. Forage habitat would decrease over time unless harvest or other events, such as a wildfire or windstorm, created additional forage. Large-scale fires could potentially occur in the Crazy PSU. Although vegetative succession would reduce forage openings over time, openings created following large fires would likely be relatively large, with long distances between hiding cover. Until hiding cover develops (about 15 to 20 years, depending on site conditions), individual animals may be more vulnerable to predation and hunting mortality in areas where large openings develop following wildfire. Overall, white-tailed deer populations would probably be maintained.

Alternative 2 – MMC's Proposed Mine

Alternative 2 would reduce the percent of cover habitat relative to forage habitat to 92 percent in summer range and to 82 percent cover habitat relative to forage in winter MAs 10 and 11, moving the cover-to-forage ratios toward the KFP-recommended conditions (Table 163). Most areas disturbed as a result of Alternative 2 would not be available as forage habitat until after mine closure and reclamation. Some areas would be reclaimed during operations and would provide foraging habitat once vegetation was established. In the long term, if reclamation were successful, areas disturbed by Alternative 2 would increase the amount of forage available for white-tailed

Table 163. Impacts on White-tailed Deer Habitat in the Crazy PSU by Mine Alternative.

Habitat Component	[1] No Mine/ Existing Conditions	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative	[4] Agency Mitigated Little Cherry Creek Impoundment Alternative
Percent Cover/forage Summer Range[1]	96/4 (60/40)	92/8	93/7	93/7
Percent Cover/forage in MAs 10 and 11[2]	83/17 (70/30)	82/18	82/18	82/18
Percent Thermal Cover in MAs 10 and 11[2]	10 (≥50)	10	10	10
Percent Cover in MAs 15, 16, and 17	86 (≥30)	83	85	83
ORD in MA 12 (mi/mi^2)	4.91 (≤0.75)	4.91	4.91	4.91
ORD in MAs 15, 16, 17, and 18 (mi/mi^2)	4.9 (≤3.0)	4.9	3.8	3.8
# Openings >20 acres in MAs 11 and 12	6	7	7	7
Key Habitat Features Affected (acres)[3]	N/A	37	14	37
# Movement Areas Affected[4]	N/A	3	3	4

N/A = Does not apply.
Numbers in parentheses represent KFP standards or desired conditions.
Impacts to white-tailed deer habitat would be the same for construction and operations phases.
[1] White-tailed deer summer range includes all MAs except MAs 10 and 11. MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*.
[2] MAs 10 and 11 are managed for big game winter range; all MAs 10 and 11 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23.
[3] Key habitat features, such as bogs and wet meadows, are represented by wetlands, as described in section 3.22, *Wetlands and Other Waters of the U.S.*
[4] Movement areas are represented by ridgelines of third order or larger drainages and riparian areas.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 164. Impacts to White-tailed Deer Habitat by Transmission Line Alternative.

Habitat Component	[A] No Trans-mission Line/Existing Conditions	[B] MMC's Proposed Trans-mission Line (North Miller Creek Alternative)	[C] Modified North Miller Creek Trans-mission Line Alternative	[D] Miller Creek Trans-mission Line Alternative	[E] West Fisher Creek Trans-mission Line Alternative
Crazy PSU					
Percent Cover/forage Summer Range[1]	96/4 (60/40)	96/4	96/4	96/4	96/4
Cover/forage Ratio in MAs 10 and 11[2]	83/17 (70/30)	83/17	83/17	83/17	83/17
Percent Thermal Cover in MAs 10 and 11[2]	10 (>50)	10	10	10	10
Percent Cover in MAs 15, 16, and 17	86 (>30)	86	86	86	86
# Openings >20 acres in MAs 11 and 12[3]	6	7	7	7	7
Key Habitat Features Affected (acres)[4]	N/A	2	3	13	13
# Movement Areas Affected[5]	N/A	3	3	2	2
All Lands in Analysis Area					
White-tailed Deer Winter Range[6]	N/A	149	191	208	179

N/A = Does not apply.
Values in parentheses represent standards.
Impacts to deer habitat would be the same for construction and operations phases.
[1] White-tailed deer summer range includes all MAs except MAs 10 and 11. MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*.
[2] MAs 10 and 11 are managed for big game winter range; all MAs 10 and 11 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23.
[3] Transmission line corridor is counted as one opening. No portion of the corridor would be greater than 600 feet to cover.
[4] Key habitat features, such as bogs, wallows, and wet meadows, are represented by wetlands, as described in section 3.22, *Wetlands and Other Waters of the U.S.*
[5] Movement areas are represented by ridgelines of third order or larger drainages and riparian areas.
[6] Based on 2008 FWP mapping.
Source: GIS analysis by ERO Resources Corp. using KNF data and 2008 FWP mapping.

Table 165. Open Road Densities in the Crazy PSU During Transmission Line Construction and Operations.

Habitat Component	[A] No Transmission Line/Existing Conditions	[B] MMC's Proposed Transmission Line (North Miller Creek Alternative)		[C] Modified North Miller Creek Transmission Line Alternative		[D] Miller Creek Transmission Line Alternative		[E] West Fisher Creek Transmission Line Alternative	
		Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]
ORD in MA 12 (mi/mi^2)[3]	4.91 (≤0.75)	4.91	4.91	4.91	4.91	5.41	4.91	5.41	4.91
ORD in MAs 15, 16, 17, and 18 (mi/mi^2)	4.9 (≤3.0)	5.1	5.0	3.7	3.7	3.8	3.7	3.8	3.7

Numbers in parentheses represent KFP standards or desired conditions.
[1] Const = during transmission line construction.
[2] Ops = during transmission line operations.
[3] All MA 12 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23. MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*.
Source: GIS analysis by ERO Resources Corp. using KNF data.

deer, thereby moving toward KFP objectives for forage habitat. The proportion of thermal cover in MAs 10 and 11 would not change as a result of Alternative 2 and would continue to be less than the desired minimum. All MAs 10 and 11 within the permit areas of the plant site, the tailings impoundment, and LAD Areas 1 and 2 would be reallocated to MA 31, which does not have a cover/forage standard. Percent cover in MAs 15, 16, and 17 in the Crazy PSU would be 3 percent less than existing conditions, but would continue to be greater than the 30 percent KFP guideline minimum. Current populations of white-tailed deer would likely be maintained in Alternative 2.

Open Road Density

As described in section 2.4.6.3, *Grizzly Bear Mitigation Plan*, Alternative 2 includes the yearlong access change in a segment of NFS road #4784. NFS road #4784 is proposed for an access change by the Rock Creek Project, and is no longer available for Montanore Mine mitigation.

Alternative 2 would not result in changes to existing ORD in MA 12 or MAs 15, 16, 17, and 18 in the Crazy PSU (Table 163). ORD would continue to exceed standards in MA 12 and MAs 15, 16, 17, and 18 in the Crazy PSU, remaining at 4.91 mi/mi^2 in MA 12 and 4.9 mi/mi^2 in MAs 15, 16, 17, and 18.

Overall, road densities would likely improve through MMC's proposed land acquisition program for grizzly bear mitigation, as described in section 2.4.6.3, *Grizzly Bear Mitigation Plan*. Acquired parcels would be managed for grizzly bear use in perpetuity, and could decrease road densities where roads could be gated or barriered, thereby benefitting white-tailed deer.

Widening, improvement, and yearlong access of the Bear Creek Road could lead to increased vehicle volumes and speed, which could increase the risk of white-tailed deer mortality from vehicle collisions.

At mine closure, all new roads (except the Bear Creek access road) constructed for the project would be reclaimed, which includes grading to match the adjacent topography, obliterating the road prism.

Forage Openings

Alternative 2 would create one opening greater than 20 acres in MAs 11 and 12 along the Bear Creek Road near U.S. 2. Effects on white-tailed deer of this new opening would likely be minimal because no point would be more than 600 feet to cover, and due to its proximity to busy roads. The loss in forage capacity may impact individual white-tailed deer in the short term, until disturbed areas were successfully revegetated. Overall populations of white-tailed deer would not likely be affected.

Movement Areas

Alternative 2 could affect potential white-tailed deer movement corridors in the Little Cherry, Poorman, and Ramsey creek drainages where the tailings impoundment, plant site, and LAD Areas would be constructed, and where other mine-related activities would occur. Facilities associated with Alternative 2 would not occur on ridgetops and would not likely directly interfere with white-tailed deer movement in these areas. Individual animals may have to adjust their localized movement patterns, but no movement barriers would be created by Alternative 2.

Key Habitat Features

About 37 acres of wetlands providing water and high-quality forage would be impacted by Alternative 2 in the Crazy PSU. Impacts to wetlands would be mitigated through implementation of the Wetland Mitigation Plan described in section 2.4.6.1, *Wetland Mitigation Plan.*

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Cover/Forage

Impacts of Alternative 3 on cover-to-forage ratios would be similar to Alternative 2 except that in Alternative 3, cover relative to forage habitat would be 93 percent in summer range, and the percent cover in MAs 15, 16, and 17 in the Crazy PSU would be 2 percent less than existing conditions (Table 163).

Open Road Density

As shown in Figure 36, Alternative 3 would include access changes (installation of barriers or gates and public access restrictions) for several roads to mitigate for the loss of big game security and impacts to grizzly bear. These road access changes are taken into account in ORD calculations. Alternative 3 would not affect ORD in MA 12, but would improve ORD in MAs 15, 16, 17, and 18 to 3.8 mi/mi^2 (Table 163). ORD would continue to be worse than standards in MA 12 and MAs 15, 16, 17, and 18 in the Crazy PSU.

Overall, road densities would likely improve through the agencies' proposed land acquisition program for grizzly bear mitigation, as described in section 2.5.7.3, *Wildlife Mitigation.* Acquired parcels would be managed for grizzly bear use in perpetuity, and could decrease road densities where roads could be gated or barriered, thereby benefitting white-tailed deer.

Widening, improvement, and yearlong access of the Bear Creek Road could lead to increased vehicle volumes and speed, which could increase the risk of white-tailed deer mortality from

vehicle collisions. For Alternative 3, wildlife mortality due to vehicle collisions would be monitored. If, in consultation with the FWP, wildlife mortality from road-killed animals were found to be excessive, mitigation measures would be developed to reduce mortality risks. The transportation plan for Alternative 3, which includes busing employees to the work site, also would reduce the risks of deer mortality from vehicle collisions.

Forage Openings

New openings created by Alternative 3 would be the same as Alternative 2.

Movement Areas

Alternative 3 could affect potential white-tailed deer movement corridors in the Little Cherry, Poorman, and Libby creek drainages where the tailings impoundment, plant site, and LAD Areas would be constructed, and where other mine-related activities would occur. Alternative 3 would affect fewer riparian corridors than Alternative 2 because disturbance from the plant and adits would be concentrated in Libby Creek. Also, the Alternative 3 impoundment would occupy less of the Little Cherry Creek riparian corridor than the Alternative 2 impoundment. Facilities associated with Alternative 3 would not occur on ridgetops and would not directly interfere with white-tailed deer movement in these areas. Individual animals may have to adjust their localized movement patterns, but it is likely that no movement barriers would result.

Key Habitat Features

About 14 acres of wetlands providing water and high-quality forage would be impacted by Alternative 3 in the Crazy PSU (Table 163). Impacts to wetlands would be mitigated through implementation of the Wetland Mitigation Plan described in 2.5.7.1, *Wetland Mitigation*.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Cover/Forage

Impacts of Alternative 4 on cover-to-forage ratios for summer range and MAs 10 and 11 would be the same as Alternative 3, except that percent cover in MAs 15, 16, and 17 in the Crazy PSU would decrease by 3 percent to 83 percent (Table 163).

Open Road Density

As shown in Figure 36, Alternative 4 would include access changes (installation of barriers or gates and public access restrictions) for several roads to mitigate for the loss of big game security and impacts to grizzly bear. These road access changes are taken into account in ORD calculations. The effects of Alternative 4 on road density would be the same as Alternative 3.

Forage Openings

New openings created by Alternative 4 would be the same as Alternative 2.

Movement Areas

Impacts of Alternative 4 on movement areas would be the same as Alternative 2.

Key Habitat Features

Impacts to key habitat features from Alternative 4 would be the same as Alternative 2.

Alternative A – No Transmission Line

Alternative A would not impact white-tailed deer or their habitat. Forage habitat would decrease over time unless harvest or other events, such as a wildfire or windstorm, created additional forage. Large-scale fires could potentially occur in the Crazy PSU. Although vegetative succession would reduce forage openings over time, openings created following large fires would likely be relatively large, with long distances between hiding cover. Until hiding cover develops (about 15 to 20 years, depending on site conditions), individual animals may be more vulnerable to predation and hunting mortality in areas where large openings develop following wildfire. Overall, white-tailed deer populations would probably be maintained.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Cover/Forage

Alternative B would not change cover relative to forage habitat in summer range, MAs 10 and 11, percent thermal cover in MAs 10 and 11, or percent cover in MAs 15, 16, and 17 in the Crazy PSU (Table 164). The proportion of thermal cover in MAs 10 and 11 would continue to be below minimum recommended levels. Percent cover in MAs 15, 16, and 17 in the Crazy PSU would continue to meet the 30 percent recommended level. All disturbed areas, such as access roads, pulling and tensioning sites, and transmission line clearing areas, would be seeded with grass and shrub species after transmission line construction. Areas where trees were trimmed, but otherwise not disturbed, would be allowed to establish naturally as grassland or shrubland. If revegetation were successful, disturbed areas of winter range would provide additional forage habitat as forage species become established, thereby moving white-tailed deer habitat conditions in the Crazy PSU toward KFP objectives. Roads built for the installation of the transmission line would be redisturbed during line reclamation. After the transmission line was removed, all newly constructed roads would be bladed, contoured, and seeded. Once vegetation re-established, redisturbed areas would provide forage habitat. Current populations of white-tailed deer would likely be maintained in Alternative B.

Open Road Density

Alternative B includes the yearlong access change in a segment of NFS road #4784. NFS road #4784 is proposed for an access change by the Rock Creek Project, and is no longer available for Montanore Mine mitigation.

During Alternative B line construction, ORD in the Crazy PSU would not change in MA 12 and would increase to 5.1 mi/mi^2 in MAs 15, 16, 17, and 18 (Table 165). ORD in MAs 15, 16, 17, and 18 would be 0.1 mi/mi^2 worse than existing densities during transmission line operations. Although ORD in the Crazy PSU would continue to exceed KFP standards, Alternative B would not contribute to ORD in MA 12. Alternative B would include the reallocation of MA 12 in a 500-foot corridor along the transmission line to MA 23. The reallocation of MA designations is described in section 3.14, *Land Use*. Because all new or opened roads in MA 12 associated with Alternative B would be within the 500-foot corridor reallocated as MA 23, a KFP amendment to allow for increased ORD in MA 12 would not be necessary.

Although the new road prism in Alternative B would remain during transmission line operations, roads opened or constructed for transmission line access would be gated or barriered on National Forest System land after transmission line construction. New roads constructed for Alternative B could improve access for hunters on foot. During the final reclamation phase following mine

closure, the transmission line would be removed, roads reclaimed, trees along the line allowed to grow, and all disturbed areas revegetated.

Helicopter line-stringing, which would last about 10 days, could contribute to short-term displacement of individual deer from the transmission line corridor. Similar effects could occur from other transmission line construction activities in areas where helicopters were not used, and would be more extensive for Alternative B than the agencies' alternatives. Disturbance impacts would be short-term and overall deer populations would not likely be affected. Except for annual inspection and infrequent maintenance operations, helicopter use and other construction activities would cease after transmission line construction until decommissioning. Helicopter use and other activities associated with decommissioning would cause similar disturbances.

Forage Openings

One opening in forest cover greater than 20 acres would be created by the Alternative B transmission line corridor. No point in the transmission line clearing area would be greater than 600 feet from cover.

Key Habitat Features

About 2 acres of wetlands providing water and high-quality forage would be impacted by Alternative B in the Crazy PSU (Table 164). Direct effects to wetlands are expected to be mostly avoided by placement and location of transmission line facilities and roads outside of wetlands and waters of the U.S. Less than 0.1 acre of wetlands and waters of the U.S. would be affected by new or upgraded road construction.

Movement Areas

Potential white-tailed deer movement corridors in the Crazy PSU could be affected where the Alternative B transmission line traversed or crossed the Howard, Libby, and Ramsey creek drainages. Alternative B could also interfere with deer movement in the Crazy PSU where it followed the ridge between Midas Creek and Howard Creek. Deer could be discouraged from using these areas during transmission line construction due to increased noise and the presence of humans and machinery, but these effects would be short-term. The width of clearing area would not likely be great enough to affect deer movement in these areas after the construction phase because sufficient cover would be present. Individual animals may have to adjust their localized movement patterns in the short term, but no barriers to movement would likely be created by Alternative B.

Impacts to White-tailed Deer on State and Private Lands

Alternative B would affect about 149 acres of white-tailed deer winter range on all lands in the analysis area, primarily in the Miller Creek drainage. Direct impacts to winter range would include a reduction in thermal and hiding cover and, once the transmission line corridor was revegetated, an increase in forage habitat. Short-term disturbance impacts in white-tailed deer winter range from transmission line construction would be minimized by restricting construction during the winter. Alternative B would result in increases in road densities on state and private lands. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction, and could result in increased white-tailed deer mortality if hunting access were allowed. State and private lands currently have high road densities and overall white-tailed deer populations would not likely be affected. Short-term habitat

displacement could occur in the analysis area during transmission line construction as a result of helicopter use.

The eastern portion of the Alternative B transmission line alignment would occur within the wildlife linkage zone in the Fisher River Valley. Impacts of Alternative B on white-tailed deer in the Fisher River Valley wildlife linkage zone would be the same as described for elk.

Alternative C – Modified North Miller Creek Transmission Line Alternative

Cover/Forage

Impacts of Alternative C on cover relative to forage habitat in both summer range and MAs 10 and 11, percent thermal cover in MAs 10 and 11, and percent cover in MAs 15, 16, and 17 in the Crazy PSU would be the same as Alternative B (Table 164).

Open Road Density

Alternative C would include access changes (installation of barriers and gates and public access restrictions) for several roads to mitigate for the loss of big game security and impacts to grizzly bear. These road access changes are taken into account in ORD calculations.

In Alternative C, during line construction and operations, ORD in the Crazy PSU would be the same as existing conditions for MAs 12 and would decrease to 3.7 mi/mi^2 in MAs 15, 16, 17, and 18 (Table 165). In Alternative C, ORD in the Crazy PSU would continue to be worse than the KFP standard, although Alternative C would result in an improvement in ORD conditions in MAs 15, 16, and 17. Alternative C would include the reallocation of MA 12 in a 500-foot corridor along the transmission line to MA 23. The reallocation of MA designations is described in section 3.14, *Land Use*. Because all new or opened roads in MA 12 associated with the Alternative C would be within the 500-foot corridor reallocated as MA 23, a KFP amendment to allow for increased ORD in MA 12 would not be necessary.

The status of new or opened roads associated with Alternative C would be the same as Alternative B, except that on National Forest System lands, the status of roads opened or constructed for transmission line access would be gated or barriered and placed in intermittent stored service after line installation was completed. Intermittent stored service roads would be closed to traffic and would be treated so they would cause little resource risk if maintenance were not performed on them during the operation period of the mine and prior to their future need. The service roads would not be used for routine maintenance of the transmission line, but could be used for emergency repairs, such as a damaged insulator. New transmission line roads on National Forest System lands would be decommissioned and revegetated after closure of the mine and removal of transmission line.

Although new roads would not result in increased motorized access, they could improve access for hunters on foot. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction, and could result in increased white-tailed deer mortality if hunting access were allowed. Overall populations would not likely be affected. During the final reclamation phase following mine closure, the transmission line would be removed, roads reclaimed, trees along the line allowed to grow, and all disturbed areas revegetated.

Helicopter use could contribute to short-term displacement of individual deer from the transmission line corridor. Helicopter line stringing would occur during a relatively short period

(about 10 days). Helicopters also would be used in some segments for vegetation clearing and structure placement and the resulting disturbance could last up to 2 months. Vegetation clearing and structure placement where helicopters were used could contribute to short-term displacement of white-tailed deer, but overall deer populations would not likely be affected. Except for annual inspection and infrequent maintenance operations, helicopter use and other transmission line construction activities would cease after until decommissioning. Helicopter use and other activities associated with line decommissioning would cause similar disturbances with similar durations.

Forage Openings

New forage openings would be the same for Alternative C as Alternative B.

Key Habitat Features

About 3 acres of wetlands providing water and high-quality forage would be impacted by Alternative C in the Crazy PSU (Table 164). Direct effects to wetlands are expected to be mostly avoided by placement and location of transmission line facilities and roads outside of wetlands and waters of the U.S. Less than 0.1 acre of wetlands and waters of the U.S. would be affected by new or upgraded road construction.

Movement Areas

Potential white-tailed deer movement corridors in the Crazy PSU could be affected where the Alternative C transmission line traversed or crossed the Howard and Libby creek drainages. Alternative C could also interfere with deer movement in the Crazy PSU where it followed the ridge between Midas Creek and Howard Creek. Deer could be discouraged from using these areas during transmission line construction due to increased noise and the presence of humans and machinery, but these effects would be short-term. The width of clearing area would not likely be great enough to affect deer movement in these areas after the construction phase because sufficient cover would be present. Individual animals may have to adjust their localized movement patterns in the short term, but no barriers to movement would likely be created by Alternative C.

Impacts to White-tailed Deer on State and Private Lands

Alternative C would affect about 191 acres of white-tailed deer winter range on all lands in the analysis area, primarily in the Miller Creek and Fisher River drainages. Direct impacts to winter range would include a reduction in thermal and hiding cover and, once the transmission line corridor was revegetated, an increase in forage habitat. Short-term disturbance impacts in white-tailed deer from transmission line construction would be minimized by restricting construction during the winter. Alternative C would result in increases in road densities on state and private lands. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction, and could result in increased white-tailed deer mortality if hunting access were allowed. State and private lands currently have high road densities and overall white-tailed deer populations would not likely be affected. Short-term habitat displacement could occur in the analysis area during transmission line construction as a result of helicopter use.

A relatively small portion of the Alternative C transmission line would cross the Fisher River Valley in the wildlife linkage zone, potentially discouraging white-tailed deer movement in a

localized area due to transmission line construction activities. Impacts of Alternative C on white-tailed deer in the Fisher River Valley wildlife linkage zone would be the same as described for elk.

Alternative D – Miller Creek Transmission Line Alternative

Cover/Forage

Impacts of Alternative D on cover relative to forage habitat in both summer range and MAs 10 and 11, percent thermal cover in MAs 10 and 11, and percent cover in MAs 15, 16, and 17 in the Crazy PSU would be the same as Alternative C (Table 164).

Open Road Density

Impacts to ORD in the Crazy PSU would be the same for Alternative D as Alternative C, except that ORD in MA 12 would increase to 5.41 mi/mi^2 and ORD would increase to 3.8 mi/mi^2 during transmission line construction. All MA 12 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23, which does not have an ORD standard. The reallocation of MA designations is described in section 3.14, *Land Use*. ORD in MA 12 would return to existing densities during transmission line operations.

Alternative D would include the same changes in road access described for Alternative C. The status, use, and reclamation of new or opened roads associated with the transmission line would be the same as Alternative C.

The effects of vegetation clearing, structure placement, and line stringing would be the same for Alternative D as Alternative C.

Forage Openings

New forage openings would be the same for Alternative D as Alternative B.

Key Habitat Features

About 13 acres of wetlands providing water and high-quality forage would be impacted by Alternative D in the Crazy PSU (Table 164). Direct effects to wetlands are expected to be mostly avoided by placement and location of transmission line facilities and roads outside of wetlands and waters of the U.S. Less than 0.1 acre of wetlands and waters of the U.S. would be affected by new or upgraded road construction.

Movement Areas

Potential white-tailed deer movement corridors in the Crazy PSU could be affected where the Alternative D transmission line traversed or crossed the Howard and Libby creek drainages. Deer could be discouraged from using these areas during transmission line construction due to increased noise and the presence of humans and machinery, but these effects would be short-term. The width of clearing area would not likely be great enough to affect deer movement in these areas after the construction phase because sufficient cover would be present. Individual animals may have to adjust their localized movement patterns in the short term, but no barriers to movement would likely be created by Alternative D.

Impacts to White-tailed Deer on State and Private Lands

Impacts to white-tailed deer winter range from Alternative D would be the same as Alternative C, except that Alternative D would affect about 208 acres of white-tailed deer winter range on all lands in the analysis area, primarily in the Miller Creek and Fisher River drainages. Impacts of Alternative D on white-tailed deer in the wildlife linkage zone in the Fisher River Valley would be the same as Alternative C.

Alternative E – West Fisher Creek Transmission Line Alternative

Cover/Forage

Impacts of Alternative E on cover relative to forage habitat in both summer range and MAs 10 and 11, percent thermal cover in MAs 10 and 11, and percent cover in MAs 15, 16, and 17 in the Crazy PSU would be the same as Alternative C (Table 164).

Open Road Density

Impacts to ORD in the Crazy PSU would be the same for Alternative E as Alternative D. Alternative E would include the same changes in road access as described for Alternative C. The status, use, and reclamation of new or opened roads associated with the transmission line would be the same as Alternative C. The effects of vegetation clearing, structure placement, and line stringing would be the same for Alternative E as Alternative C.

Forage Openings

New forage openings would be the same for Alternative E as Alternative B.

Key Habitat Features

Impacts to key habitat features would be the same for Alternative E as Alternative D.

Movement Areas

Potential white-tailed deer movement corridors in the Crazy PSU could be affected where the Alternative E transmission line traversed or crossed the Howard and Libby creek drainages. Deer could be discouraged from using these areas during transmission line construction due to increased noise and the presence of humans and machinery, but these effects would be short-term. The width of clearing area would not likely be great enough to affect deer movement in these areas after the construction phase because sufficient cover would be present. Individual animals may have to adjust their localized movement patterns in the short term, but no barriers to movement would likely be created by Alternative E.

Impacts to White-tailed Deer on State and Private Lands

Impacts to white-tailed deer winter range from Alternative E would be the same as Alternative C except that Alternative E would affect about 179 acres of white-tailed deer winter range on all lands in the analysis area, primarily in the Fisher River and Miller Creek drainages. Impacts of Alternative E on white-tailed deer in the wildlife linkage zone in the Fisher River Valley would be the same as Alternative C.

Combined Mine-Transmission Line Effects

Impacts to white-tailed deer habitat in the analysis area from combined mine-transmission line alternatives are described below and shown in Table 166.

Cover/Forage

The combined mine-transmission line alternatives would not change the percent thermal cover in MAs 10 and 11. In general, the combined action alternatives would result in a decrease in percent cover relative to forage habitat. All combined action alternatives would result in a 1 percent decrease in cover relative to forage habitat in MAs 10 and 11 (Table 166). Alternative 2B would result in a 5 percent decrease in cover relative to forage habitat in summer range, while cover in summer range would fall by 4 percent in all other combined action alternatives. Alternatives 2B, 4C, 4D, and 4E would reduce cover in MAs 15, 16, and 17 by 3 percent, indicating that mine Alternatives 2 and 4 would have the greatest influence on cover in MAs 15, 16, and 17.

Open Road Density

Alternative 2B includes an access change in NFS road #4724 from April 1 to June 30 and the yearlong access change in a segment of NFS road #4784 to mitigate for impacts to grizzly bears. The agencies' alternatives would include access changes (installation of barriers and gates and public access restrictions) for several roads to mitigate for the loss of big game security and impacts to grizzly bear (see section 2.5.7.3, *Wildlife Mitigation*). These changes in road access are taken into account in ORD calculations. NFS road #4784 is proposed for an access change by the Rock Creek Project, and is no longer available for Montanore Mine mitigation.

Current ORD in MA 12 and MAs 15, 16, 17, and 18 in the Crazy PSU is higher than the standard (Table 167). Alternatives 3D, 3E, 4D, and 4E would increase ORD in MA 12 to 5.41 mi/mi^2 in the Crazy PSU during transmission line construction, but these increases in ORD would be temporary. Alternative 2B would increase ORD in MAs 15, 16, 17, and 18 in the Crazy PSU to 4.7 mi/mi^2 during construction and to 4.4 mi/mi^2 during operations, requiring a project-specific amendment to the KFP. Due to access changes (installation of barriers or gates and public access restrictions) associated with mitigation, the combined agencies' alternatives would decrease ORD in MAs 15, 16, 17, and 18 during transmission line construction and would decrease operations by 0.5 mi/mi^2 during construction and operations. For Alternative B, during transmission line operations ORD in MAs 15, 16, 17, and 18 would be 0.1 mi/mi^2 worse than existing densities. All action alternatives would include the reallocation of MA 12 in a 500-foot-wide corridor along the transmission line to MA 23. The reallocation of MA designations is described in section 3.14, *Land Use*. All new or opened roads in MA 12 associated with the combined action would be within the 500-foot corridor reallocated as MA 23, and would not require a KFP amendment to allow for increased ORD.

In all action alternatives, the new road prism would remain during transmission line operations. In the agencies' alternatives, roads would be placed into intermittent stored service after line installation was completed. Intermittent stored service roads would be closed to traffic and would be treated so they would cause little resource risk if maintenance were not performed on them during the operation period of the mine and prior to their future need. The service roads would not be used for routine maintenance of the transmission line, but could be used for emergency repairs, such as a damaged insulator. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction. During the final reclamation phase following mine closure, all new roads would be removed, roads reclaimed, and all disturbed areas revegetated. For agencies' alternatives, roads would be decommissioned at mine closure.

Table 166. Impacts on White-tailed Deer Habitat in the Analysis Area by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] No Mine Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Alternative		
		TL-B	TL-C	TL-D	TL-E	TL-C	TL-D	TL-E
Crazy PSU								
Percent Cover/forage Summer Range[1]	96/4 (60/40)	91/9	92/8	92/8	92/8	92/8	92/8	92/8
Percent Cover/forage in MAs 10 and 11[2]	83/17 (70/30)	82/18	82/18	82/18	82/18	82/18	82/18	82/18
Percent Thermal Cover in MAs 10 and 11[2]	10 (>50)	10	10	10	10	10	10	10
Percent Cover in MAs 15, 16, and 17	86 (>30)	83	85	85	85	83	83	83
# Openings >20 acres in MAs 11 and 12[3]	6	8	8	8	8	8	8	8
Key Habitat Features Affected (acres)[4]	N/A	39	16	15	15	39	38	38
# Movement Areas Affected[5]	N/A	5	6	5	5	7	6	6
All Lands in Analysis Area								
White-tailed Deer Winter Range Impacted (acres)[6]	0	149	191	208	179	191	208	179

N/A = Does not apply.
Numbers in parentheses represent KFP standards or desired conditions.
Impacts shown are for the transmission line construction phase, which represents maximum estimated impacts.
[1] White-tailed deer summer range includes all MAs except MAs 10 and 11. MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*.
[2] MAs 10 and 11 are managed for big game winter range; all MAs 10 and 11 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23.
[3] Transmission line corridor is counted as one opening. Other than the corridor length, no portion of the corridor would be greater than 600 feet to cover.
[4] Key habitat features, such as bogs and wet meadows, are represented by wetlands, as described in section 3.22, *Wetlands and Other Waters of the U.S.* Represents maximum impacts based on additive impacts of the combined mine-transmission line alternatives.
[5] Movement areas are represented by ridgelines of third order or larger drainages and riparian areas.
[6] Based on 2008 FWP mapping.
Source: GIS analysis by ERO Resources Corp. using KNF data and 2008 FWP mapping.

Table 167. Open Road Densities in the Crazy PSU by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] No Mine Existing Condition	[2] MMC's Proposed Mine		[3] Agency Mitigated Poorman Impoundment Alternative						[4] Agency Mitigated Little Cherry Creek Impoundment Alternative					
		TL-B		TL-C		TL-D		TL-E		TL-C		TL-D		TL-E	
		Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]
ORD in MA 12 (mi/mi^2)[3]	4.91 (≤0.75)	4.91	4.91	4.91	4.91	5.41	4.91	5.41	4.91	4.91	4.91	5.41	4.91	5.41	4.91
ORD in MAs 15, 16, 17, and 18 (mi/mi^2)[3]	4.3 (≤3.0)	4.7	4.4	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8

Numbers in parentheses represent KFP standards or desired conditions.
[1] Const = during mine construction.
[2] Ops = during transmission line operations.
[3] All MA 12 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23.
ORD = open road density. MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Overall, road densities would likely improve through MMC's or the agencies' grizzly bear land acquisition program, as described in sections 2.4.6.3, *Grizzly Bear Mitigation Plan* and 2.5.7.3, *Wildlife Mitigation*. Acquired parcels would be managed for grizzly bear use in perpetuity, and could improve road densities where roads could be closed. The agencies' land acquisition program would likely be more effective at reducing road densities than MMC's proposed land acquisition program because more land would be protected.

Widening, improvement, and yearlong access of the Bear Creek Road could lead to increased vehicle volumes and speed, which could increase the risk of white-tailed deer mortality from vehicle collisions. Combined agencies' alternatives would include a transportation plan requiring that employees be bused to the work site, reducing the risk of white-tailed deer mortality from vehicle collisions. For the combined agencies' alternatives, wildlife mortality due to vehicle collisions would be monitored. If, in consultation with the FWP, wildlife mortality from road-killed animals were found to be excessive, mitigation measures would be developed to reduce mortality risks.

For all action alternatives, helicopter and other transmission line construction activities could result in short-term displacement of white-tailed deer from the transmission line corridor and surrounding habitat. Disturbance from helicopter use and other transmission line construction activities are described for Alternatives B and C above.

Forage Openings

In all combined action alternatives, two openings greater than 20 acres would be created. One opening greater than 20 acres in MAs 11 and 12 would be created along the Bear Creek Road near U.S. 2. Effects on white-tailed deer of this new opening would likely be minimal because no point would be more than 600 feet to cover, and due to its proximity to busy roads. No point in opening created by the transmission line clearing area would be greater than 600 feet from cover. The loss in forage capacity in these areas may impact individual white-tailed deer in the short term, until disturbed areas were successfully revegetated. Overall white-tailed deer populations would not likely be affected.

Key Habitat Features

Alternatives 2B, 4C, 4D, and 4E would have the greatest impacts on wetland habitat potentially providing water and high-quality forage for white-tailed deer in the Crazy PSU. Impacts of the other combined action alternatives on wetlands would be comparable, ranging from 15 acres for Alternatives 3D and 3E to 16 acres for Alternative 3C. Impacts to wetlands would be mitigated through implementation of the Wetland Mitigation Plan described in section 2.5.7.1, *Wetland Mitigation*. For the transmission lines, direct effects to wetlands are expected to be mostly avoided by placement and location of transmission line facilities and roads outside of wetlands and waters of the U.S.

Movement Areas

Alternatives 2B, 3D, and 3E would affect the fewest number of potential white-tailed deer movement areas. The agencies' alternatives could interfere with white-tailed deer movement where it followed the east-facing ridge north of the Sedlak Park Substation. Alternative 2B would be located at a lower elevation in the Fisher River valley and would not impact this area, but could affect white-tailed deer movement in the Ramsey Creek drainage. Alternatives 2B, 3C, and 4C could interfere with white-tailed deer movement where the transmission lines followed the

ridge between Midas Creek and Howard Creek. Potential white-tailed deer movement along the ridge between Miller Creek and Howard Creek could be affected by Alternatives 4C and 4D. White-tailed deer could be discouraged from using these areas during transmission line construction due to increased noise from helicopters and machinery and the presence of humans, but these effects would be short-term. The width of clearing area would not likely be great enough to affect white-tailed deer movement in this area after the construction phase because sufficient cover would be present.

White-tailed Deer Winter Range on All Lands

Impacts to white-tailed deer winter range from the combined action alternatives on all lands in the analysis area, including private and state lands, would range between 149 and 208 acres. Alternatives 3D and 4D would have the greatest impacts to white-tailed deer winter range, while Alternative 2B would have the fewest impacts to winter range. In all combined action alternatives, direct impacts to winter range would include a reduction in thermal and hiding cover and, once the transmission line corridor was revegetated, an increase in forage habitat. Impacts to white-tailed deer winter range would likely be minor in all combined action alternatives, relative to the total amount of winter range habitat available in the analysis area. Impacts to white-tailed deer winter range would be minimized through application of construction timing restrictions in white-tailed deer winter range. All combined action alternatives would result in increased road densities on state and private lands. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction, and could result in increased white-tailed deer mortality if hunting access were allowed. State and private lands currently have high road densities and overall white-tailed deer populations would not likely be affected. Short-term habitat displacement could occur in the analysis area during transmission line construction as a result of helicopter use.

Wildlife Linkage Zone

The eastern segment of the Alternative 2B transmission line corridor would occur within the wildlife linkage zone in the Fisher River Valley and relatively small segments of the transmission line corridors for all combined action alternatives would cross the Fisher River Valley in the wildlife linkage zone. The portions of the combined agencies' alternatives that would parallel U.S. 2 would be located upslope and out of the Fisher River Valley, and would not likely affect white-tailed deer movement in the linkage zone. Impacts of the combined action alternatives on white-tailed deer in the Fisher River Valley wildlife linkage zone are the same as described for elk.

Cumulative Effects

Roads constructed in association with timber harvest, mining, and other development have cumulatively increased road densities in the analysis area. Development of private lands within the analysis area, including commercial timber harvest, land clearing, home construction, and road construction has contributed to increased disturbance of white-tailed deer and a loss or reduction in quality of white-tailed deer foraging and winter habitat, and is expected to continue. Fire suppression has resulted in the encroachment of conifers into foraging habitat and aging of shrub habitat.

Surface impacts from other reasonably foreseeable actions in the Crazy PSU would be minimal, and would not result in any measurable changes in cover or forage habitat; cover-to-forage ratios are not evaluated for cumulative effects on white-tailed deer.

New roads and roads closed for mitigation associated with reasonably foreseeable actions, including the Wayup Mine/Fourth of July Road Access Project, will contribute to cumulative effects on ORD in the Crazy PSU. The No Action alternatives (Alternative 1 and Alternative A) would not contribute to cumulative impacts on white-tailed deer. Cumulative impacts of the combined mine-transmission line alternatives, in combination with other reasonably foreseeable actions, on ORD in the Crazy PSU are shown in Table 168. Because none of the action alternatives would increase road densities in the Crazy PSU in MA 12, they would not contribute to cumulative road densities in MA 12; ORD in MA 12 is not displayed.

Open Road Density

Reasonably foreseeable actions, including the Wayup Mine/Fourth of July Road Access Project, Plum Creek activities, the Rock Creek Project, and the Miller-West Fisher Vegetation Management Project, would not contribute to cumulative ORD in MA 12, and any changes in ORD in MA 12 would be due to the proposed Montanore Project. Due to road access changes associated with reasonably foreseeable actions, cumulative impacts in all agencies' alternatives would result in reductions in ORD in MAs 15, 16, 17, and 18 in the Crazy PSU both during and after transmission line construction. For Alternative B, despite road access changes associated with other projects, ORD in MAs 15, 16, 17, and 18 in the Crazy PSU would increase to 4.5 mi/mi^2 during transmission line construction, but would be better than existing densities after the transmission line was built. In all combined action alternatives, cumulative ORD would remain greater than KNF standards in MA 12 and MAs 15, 16, 17, and 18.

Forage Openings

Only a few openings greater than 20 acres would be created in the Crazy PSU as a result of the action alternatives. Surface impacts from other reasonably foreseeable actions in the Crazy PSU would be minimal, and would not result in any new openings greater than 40 acres.

Key Habitat Features

All action alternatives would result in the disturbance of wetlands providing potential water and high-quality forage habitat for white-tailed deer in the Crazy PSU. Impacts to wetlands would be mitigated through implementation of the Wetland Mitigation Plan. Other reasonably foreseeable actions would contribute to losses of wetland habitat. Impacts to wetlands from reasonably foreseeable actions would require mitigation under the Clean Water Act.

Movement Areas

The mine action alternatives could interfere with white-tailed deer movement in the Little Cherry, Poorman, and Libby creek corridors. The transmission line alternatives could affect white-tailed deer movement where the lines traversed or crossed the Howard and Libby creek drainages. Alternative B could also disrupt movement in the Ramsey Creek corridor. Disturbance-related impacts from transmission line construction would be short-term and the width of clearing area would not likely be great enough to affect deer movement after the construction phase. Other reasonably foreseeable actions could impede deer movement in specific areas due to increased road use and noise disturbance, but KNF riparian standards would minimize activities in riparian areas. While some cumulative effects to white-tailed deer movement could occur, they would likely be minimal.

Table 168. Cumulative Impacts to Open Road Densities in the Crazy PSU by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] Existing Condition	[1] No Mine[1]	[2] MMC's Proposed Mine		[3] Agency Mitigated Poorman Impoundment Alternative						[4] Agency Mitigated Little Cherry Creek Impoundment Alternative					
			TL-B		TL-C		TL-D		TL-E		TL-C		TL-D		TL-E	
			Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]
ORD in MA 12 (mi/mi^2)[4]	4.91 (≤0.75)	4.91 (<0.75)	4.91	4.91	4.91	4.91	5.41	4.91	5.41	4.91	4.91	4.91	5.41	4.91	5.41	4.91
ORD in MAs 15, 16, 17, and 18 (mi/mi^2)	4.3 (≤3.0)	4.1 (<3.0)	4.5	4.2	4.2	3.8	4.2	3.8	4.2	3.8	4.2	3.8	4.2	3.8	4.2	3.8

Numbers in parentheses represent KFP standards or desired conditions.

[1] Effects shown include effects of the Wayup Mine/Fourth of July Road Access Project, Plum Creek activities, the Rock Creek Project, and the Miller-West Fisher Vegetation Management Project. Alternative 1 (No Transmission Line) would not contribute to cumulative effects on ORD.

[2] Const = during mine construction.

[3] Ops = during transmission line operations.

[4] All MA 12 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23. MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*.

ORD = open road density.

Source: GIS analysis by ERO Resources Corp. using KNF data.

White-tailed Deer Winter Range on All Lands

All combined action alternatives, in combination with other reasonably foreseeable actions, especially the Miller-West Fisher Vegetation Management Project, would result in cumulative impacts to white-tailed deer winter range on all lands in the analysis area, resulting in a reduction of thermal and hiding cover and, once disturbed areas were revegetated, an increase in forage habitat. Cumulative impacts of all combined action alternatives would likely be minor because application of construction timing restrictions in winter range would minimize impacts. The combined action alternatives, in combination with Plum Creek activities, could result in cumulative disturbance to white-tailed deer on private lands in the analysis area, and could displace white-tailed deer away from areas of disturbance. State and private lands currently have high road densities and overall white-tailed deer populations would not likely be affected.

3.24.3.3.4 Regulatory/Forest Plan Consistency

KFP. During transmission line construction and operations, all combined action alternatives would change ORD in the Crazy PSU in MAs 15, 16, 17, and 18, where ORD is currently greater than the KFP standard. Alternative B would increase ORD in the Crazy PSU in MAs 15, 16, 17, and 18. Although the agencies' alternatives would improve ORD in the Crazy PSU in MAs 15, 16, 17, and 18, they would not decrease ORD to meet KFP standards. A KFP amendment allowing ORD greater than the KFP standard in the Crazy PSU in MAs 15, 16, 17, and 18 would be required for all combined action alternatives. With the incorporation of the KFP amendment, all combined action alternatives would meet all KFP direction for general forest MIS species (KFP Vol. 1, II-22 #3, III-45 #8 and III-49 #7).

All action alternatives would result in cover-to-forage ratios in the Crazy PSU closer to recommended ratios. ORD in the Crazy PSU currently exceeds the KFP standard in MA 12. Alternatives 3D, 3E, 4D, and 4E would contribute to ORD in MA 12 in the short term during transmission line construction. All combined action alternatives would include a project-specific amendment to the KFP to change all MAs 10, 11, and 12 within a 500-foot corridor designated for the transmission line corridor to MA 23. The amendment is for the duration of the proposed Montanore Project. KFP amendments have been discussed section 3.14.4, *Environmental Consequences*. All new or opened roads in MA 12 associated with the transmission line would be within the 500-foot corridor reallocated as MA 23.

State Management. White-tailed deer and other ungulate populations are managed by FWP. Proposed actions would not prevent the state from continuing to manage these species as harvestable populations.

Summary General Forest MIS Statement. Based on the white-tailed deer analysis and the KNF Conservation Plan (Johnson 2004a), all combined mine-transmission line alternatives should provide general forest species habitat with sufficient quality and quantity of the diverse age classes of vegetation needed for viable populations. In all combined mine-transmission line alternatives, sufficient general forest habitat should be available; the populations of species using that habitat should remain viable.

3.24.3.4 Mountain Goat

3.24.3.4.1 Analysis Area and Methods

The mountain goat is the KNF MIS for alpine habitat. Mountain goat ecology, biology, habitat use, status, and conservation are described and summarized in Joslin (1980) and Brandborg

(1955). That information is incorporated by reference. Mountain goat occurrence data come from District wildlife observation records and Forest historical data (NRIS FAUNA) and other agencies (FWP).

Habitat mapping for mountain goat is derived from Joslin (1980), and is categorized according to Management Situation (MS 1, 2, or 3) and seasonal use (winter, summer, or transitional range). MS 1 areas are critical mountain goat range, as documented with numerous observations. MS 2 areas are where few observations of mountain goats have been recorded. MS 2 areas do not currently support goat populations, although they may have in the past, and they appear to have all the features of suitable habitat. MS 3 areas are not known to provide important goat habitat, but because of their juxtaposition to MS 1 and MS 2 areas, it would not be unusual to observe goats in these areas. Habitat categories are defined in Joslin (1980). MS 1 areas are regularly used by mountain goats during one or more seasons and goats in these areas are more sensitive to human impacts and activity (Joslin 1980).

Mountain goats have been shown to be sensitive to human disturbances such as helicopter use, blasting, and road building (Joslin 1980). Increased disturbance may result in displacement from suitable habitat. Mountain goats may also remain in proximity of the disturbance, potentially suffering increased stress levels that could result in a decline in reproductive rates (ibid.). Distances at which goats may be affected by such disturbance are not known. In absence of species-specific data, the influence zones suggested for grizzly bear in the Cumulative Effects Model (USDA Forest Service 1988a) were used to estimate the displacement effects of disturbances associated with mine and transmission line construction and operations on mountain goats.

Effects of the alternatives were evaluated based on impacts to mountain goat habitat. The analysis area for project impacts to individuals and their habitat includes all mountain goat habitat in the Crazy, Silverfish, Bull, Rock, and Green PSUs (Figure 88). This zone includes the year-round area occupied by mountain goats in the southern Cabinet Mountains. The boundary for cumulative effects is the KNF and the FWP Mountain Goat HD 100. Mountain goat habitat does not occur on private land within the zone of influence of the proposed project.

The impacts analysis includes an evaluation of the potential benefits to mountain goats from mitigation measures proposed by MMC or the agencies, such as funding for monitoring of mountain goat responses to mine-related impacts, prohibiting blasting at adit portals between June 1 and June 30, access changes, land acquisitions, and prohibiting employees from carrying firearms.

3.24.3.4.2 Affected Environment

Mountain goats are found primarily in alpine habitat and high elevation coniferous forest stands throughout the year. Goats annually use the same summer and winter ranges, travel corridors, kidding areas, and mineral licks, and rarely explore new territory, which make them vulnerable to human activities or habitat changes in their range (Joslin 1980). Habitat use information and traditional use patterns are learned behaviors passed down through generations. If traditional use patterns are altered and seasonal home range knowledge is not transferred to offspring, then suitable ranges may not be recolonized (ibid.). Mountain goats use steep rock outcrops and escarpments for escape from predators and security during the kidding period, and feed on vegetation found in the rock crevices. They use coniferous timber as shelter from severe weather, particularly during winter. Mountain goats eat a wide variety of foods, but in the Cabinet

Mountains, shrubs are the major component of their diet year-round. Grasses are also consumed when available. In winter, goats browse on trees (Joslin 1980).

Mountain goat winter range is usually found in spruce-fir forests that are characterized by 80 percent slopes, average snow depths of less than 20 inches, or where the terrain extends to areas of lower elevation with an average snow depth less than 20 inches. During the winter, mountain goats usually forage on shrubs and trees. During mild winters, mountain goats have been known to travel between several winter areas (Joslin 1980). About 6,800 acres of confirmed winter range was mapped in the Cabinet Mountain range in 1980. An additional 21,000 acres of probable and possible winter range were mapped in the East and West Cabinet Mountains during the 1979 and 1980 study by Joslin (ibid.).

The analysis area contains about 151,208 acres of mountain goat habitat (Table 169), including 60,224 acres of winter range MS 1 habitat. During the 1988–1989 environmental studies, most goats in the area wintered in Rock Creek, but two were observed above Libby Creek and one above Ramsey Creek (Western Resource Development 1989f). FWP has identified the area above Rock Creek as confirmed winter range; the south-facing slopes above upper West Fisher Creek as probable winter range; and south-facing slopes above Libby, Ramsey, and Poorman creeks as possible winter range (Joslin 1980).

Historical population numbers were estimated to be 350 goats in the Cabinet Mountains in 1950, declining to between 95 and 160 in 1980 (Casebeer *et al.* 1950; Joslin 1980). About 88 goats were counted during FWP standardized sampling surveys of HD 100 (Cabinet Mountains) during spring 2008, which is greater than the average of 65 goats counted (FWP 2008c). About 24 percent of the goats observed in 2008 were kids, corresponding to an average rate of reproduction (ibid.). During surveys conducted in 1988 and 1989, 40 to 55 mountain goats were estimated to occupy rocky ridges in portions of the analysis area (Western Resource Development 1989f). During all seasons, most of the activity was in and near the headwalls of the Rock, Libby, and West Fisher creek drainages, but some solitary males were observed in the Ramsey and Poorman creek areas. The closest documented wintering area on the east side of the Cabinet Mountains was on the south-facing slope of Shaw Mountain in Libby Creek. Two goats were seen in this area in 1989 (ibid.), which is about 0.5 mile north of the Libby Adit site. More recent observations by FWP personnel indicate that Libby, Ramsey, West Fisher, Poorman, and Rock creeks represent a population epicenter for mountain goats in the southern Cabinet Mountains (Brown, pers. comm. 2008).

Mountain goat breeding occurs primarily in November (Joslin 1980). During the breeding season, mountain goats are primarily observed in the project vicinity in the Libby, Ramsey, and West Fisher creek drainages (Brown, pers. comm. 2007).

Summer transitional mountain goat habitat provides high-quality forage areas within high elevation coniferous forests and rock outcrops. Although winter range appears to be the limiting factor to goat densities in the Cabinet Mountains, quality summer range is also of paramount importance in providing highly nutritious forage, which fortifies the body for winter and sustains the population from year-to-year (Joslin 1980). Ridgelines are commonly used as travel corridors between summer transitional habitat (ibid.). About 63,688 acres of summer transitional MS 1 habitat occurs in the analysis area.

Mountain goats generally give birth to their kids in late May or early June on lower slopes at the mouth of drainages (Joslin 1980). The areas around Shaw Mountain and Leigh Lake appear to be important for mountain goat kidding (Brown, pers. comm. 2005, 2008).

3.24.3.4.3 Environmental Consequences

Physical impacts to mountain goat habitat from the mine alternatives would be greatest for Alternative 2, which would affect 151 acres, due to the Ramsey Plant Site. Alternatives 3 and 4 would directly impact 98 acres of mountain goat habitat. Alternative 1 would have no direct impacts on mountain goats.

Impacts to mountain goats from the transmission line alternatives are shown in Table 169 and described in the following subsections. The analysis of the effects of human activity on goats is based on activity-specific buffers, and includes the effects of open roads. Road access changes associated with mitigation were determined for combined action alternatives. It is not possible to attribute these access changes to individual mine and transmission line alternatives independent of one another. Because the disturbance buffer applied to new or opened roads associated with the transmission line is encompassed entirely by the buffer applied for helicopter disturbance, human disturbance effects for transmission line construction are calculated based on the area of overlap between the helicopter disturbance buffer and mountain goat habitat. It is assumed that human activity would not affect mountain goats during transmission line operations. The evaluation of the effects of human activity on mountain goats from individual mine alternatives may be inferred from impact calculations for the combined mine-transmission line alternatives shown in Table 170.

Table 169. Mountain Goat Habitat Affected by Transmission Line Alternative.

Habitat Component	[A] No Transmission Line/Existing Conditions (acres)	[B] MMC's Proposed Transmission Line (North Miller Creek Alternative) (acres)		[C] Modified North Miller Creek Transmission Line Alternative (acres)		[D] Miller Creek Transmission Line Alternative (acres)		[E] West Fisher Creek Transmission Line Alternative (acres)	
		Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]
Mountain Goat Habitat Available (acres)	151,208	151,161 (-47)	151,161 (-47)	151,208 (0)	151,208 (0)	151,208 (0)	151,208 (0)	151,208 (0)	151,208 (0)
Habitat Affected by Human Activity[3, 4] (acres)	8,303	12,180 (+3,877)	8,303 (0)	8,927 (+624)	8,303 (0)	9,032 (+729)	8,303 (0)	9,032 (+729)	8,303 (0)

Number in parentheses is the change in habitat acres due to the alternative compared to existing conditions.
[1]Const = during transmission line construction.
[2]Ops = during transmission line operations
[3]Acres affected by human activity do not include areas of overlap from different sources of disturbance. Disturbance effects were calculated by applying the following buffers:
Open roads (including seasonally open roads that are open during bear year from April 1 to Nov. 30) = 0.25 mile on each side.
Helicopter use = 1 mile on each side of disturbance.
[4] For Alternative B, the use of helicopters during line construction would be at the discretion of MMC. The agencies assumed that helicopters would not be used for vegetation clearing or structure placement for Alternative B. Helicopter use was assumed for line stringing only.
Source: GIS analysis by ERO Resources Corp. using KNF data derived from Joslin 1980.

Table 170. Mountain Goat Habitat Affected by Combined Mine-Transmission Line Alternative.

Habitat Component	[1] No Mine Existing Condition	[2] MMC's Proposed Mine		[3] Agency Mitigated Poorman Impoundment Alternative						[4] Agency Mitigated Little Cherry Creek Impoundment Alternative					
	TL-A	TL-B		TL-C		TL-D		TL-E		TL-C		TL-D		TL-E	
		Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]
Mountain Goat Habitat Available (acres)	151,208	151,010 (-198)	151,010 (-198)	151,110 (-98)	151,110 (-98)	151,110 (-98)	151,110 (-98)	151,110 (-98)	151,110 (-98)	151,110 (-98)	151,110 (-98)	151,110 (-98)	151,110 (-98)	151,110 (-98)	151,110 (-98)
Habitat Affected by Human Activity[3,4] (acres)	8,303	16,092 (+7,789)	10,994 (+2,691)	13,870 (+5,567)	10,818 (+2,515)	13,956 (+5,656)	10,818 (+2,515)	13,956 (+5,656)	10,818 (+2,515)	13,870 (+5,567)	10,818 (+2,515)	13,956 (+5,656)	10,818 (+2,515)	13,956 (+5,656)	10,818 (+2,515)

Numbers in parentheses is the change in habitat acres due to the alternatives compared to existing conditions.
[1] Const = during project construction.
[2] Ops = during project operations.
[3] Acres of disturbance do not include areas of overlap from different sources of disturbance. Disturbance effects were calculated by applying the following buffers:
Open roads (including seasonally open roads that are open during bear year from April 1 to Nov. 30) = 0.25 mile on each side.
Helicopter construction = 1 mile on each side of disturbance.
[4] For Alternative 2B, the use of helicopters during line construction would be at the discretion of MMC. The agencies assumed that helicopters would not be used during vegetation clearing or structure placement for Alternative 2B. Helicopter use was assumed for line stringing only.
Source: GIS analysis by ERO Resources Corp. using KNF data derived from Joslin 1980.

Alternative A – No Transmission Line

Alternative A would have no impacts on mountain goat habitat.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Alternative B would result in the physical disturbance of about 47 acres of mountain goat habitat, due to disturbance in the transmission line clearing area in Ramsey Creek (Table 169). During the construction phase, Alternative B would result in additional short-term disturbance to about 3,877 acres of goat habitat, primarily due to helicopter line stringing in the Ramsey Creek area. Line stringing conducted by helicopter could displace goats from suitable habitat or reduce their ability to effectively use the available habitat in the short term. Individual goats could suffer increased stress levels from disturbance during helicopter line stringing, but these impacts would last no more than 10 days and would not likely affect goat populations. Disturbance effects could also occur from other transmission line construction activities in areas where helicopters were not used. Except for annual inspection and infrequent maintenance operations, helicopter and other transmission line construction activities would cease after transmission line construction until decommissioning. Helicopter use and other activities could result in short-term disturbance of mountain goats during line decommissioning.

Alternative C – Modified North Miller Creek Transmission Line Alternative

Alternative C would have no physical impacts on mountain goat habitat (Table 169). Line stringing conducted by helicopter could displace goats temporarily from suitable habitat or reduce their ability to effectively use the available habitat. Helicopter construction would not occur in proximity to mountain goat habitat, and is not expected to affect mountain goats. Alternative C would have less effect on mountain goats than Alternative B. During the construction phase, Alternative C would result in increased short-term disturbance to about 624 acres of goat habitat, primarily due to helicopter line stringing at the mouth of upper Libby Creek. Individual goats could suffer increased stress levels from disturbance during helicopter line stringing, but these impacts would last no more than 10 days and would not likely affect goat populations. In Alternative C, except for annual inspection and infrequent maintenance operations, helicopter use and other transmission line construction activities would cease after transmission line construction until decommissioning, similar to Alternative B.

Alternative D – Miller Creek Transmission Line Alternative

Impacts of Alternative D on mountain goats would be the same as Alternative C, except that Alternative D would result in slightly more human disturbance than Alternative C. During the construction phase, Alternative D would result in additional short-term disturbance to about 729 acres of goat habitat.

Alternative E – West Fisher Creek Transmission Line Alternative

Impacts of Alternative E on mountain goats would be the same as Alternative D.

Combined Mine-Transmission Line Effects

Impacts of the combined mine-transmission line alternatives are shown in Table 170 and described below.

Alternative 2B would result in direct losses of about 198 acres of mountain goat habitat, mostly due to disturbance from the Rock Lake Ventilation Adit and Ramsey Plant Site (Table 170). Less

goat habitat would be lost or disturbed by the combined agencies' alternatives because the adits and plant site would be located in the same drainage (*i.e.*, Libby Creek). All combined agencies' alternatives would physically disturb about 98 acres of goat habitat.

Disturbance effects from human activity would have a much greater impact on the mountain goat than physical impacts to goat habitat, and would include disturbance from activities associated with blasting, construction of the plant and adit sites, road construction and use, plant and adit operations, and helicopter use that could displace goats from suitable habitat or reduce their ability to effectively use the available habitat. Disturbance from helicopter use and other transmission line construction activities are described above for the transmission line alternatives. Disturbance from blasting during mine construction could result in habitat displacement and increased stress levels for mountain goats, but would be short-term. Blasting would likely be mostly underground at the Libby Adit, where a maximum of two rounds of blasting would occur at the surface. The Ramsey Adits would probably require a maximum of two rounds of surface blasting per adit. The ventilation raise would be constructed from inside the mine and would not require any surface blasting, except for creation of the surface opening. Construction of the Ramsey Adits for Alternative 2B and the lower and upper Libby Adits for the combined agencies' alternatives is expected to take about 1 year. The construction phase in all combined action alternatives is expected to last 2 to 3 years. Noise and human activity associated with plant construction could also cause goats inhabiting surrounding areas to move to other portions of their home range for the duration of construction activities. Goats could suffer increased stress levels from disturbance during construction and operations that could result in a decline in reproductive rates.

During the construction phase, Alternative 2B would result in the most additional human disturbance to goat habitat, affecting about 7,789 acres. Human disturbance impacts from Alternative 2B would be greater than the combined agencies' alternatives due to helicopter line stringing, plant construction, and adit construction in Ramsey Creek. Less goat habitat would be disturbed by combined agencies' alternatives because the adits and plant site would be located in the same drainage (*i.e.*, Libby Creek), and because the transmission line would end at the mouth of Libby Creek. The agencies' alternatives would result in additional disturbance to between 5,567 acres and 5,653 acres during project construction. For the combined agencies' alternatives, no blasting would occur at the adits from June 1 to June 30, which would minimize disturbance to the potential goat kidding area on Shaw Mountain. The combined agencies' alternatives also would include funding for monitoring of mountain goat responses to mine-related impacts. If, in consultation with the FWP, mine disturbance were found to have a substantial impact on goat populations, mitigation measures would be developed to reduce the impacts of mine disturbance.

During mine operations, additional disturbance to goat habitat would range from 2,515 acres for the combined agencies' alternatives to 2,691 acres for Alternative 2B. Long-term disturbance to mountain goats during operations, such as noise and human activity, could cause goats to experience increased stress levels or to move from currently inhabited surrounding areas to other portions of their home range.

Most disturbances to goats would be short-term, and long-term disturbance would increase on a relatively small proportion (less than 0.01 percent) of goat habitat in the analysis area. In all combined action alternatives, some disturbance effects would be offset by access changes (installation of gates or barriers and public access restrictions) and habitat acquisitions planned as mitigation for the impacts to grizzly bear and big game security. Acquired parcels would be

managed for grizzly bear use in perpetuity, and could improve or contribute suitable mountain goat habitat if the acquired parcels provided appropriate habitat characteristics and could be managed to improve mountain goat habitat. The combined agencies' alternatives would include more road access changes and habitat acquisition, and would more effectively mitigate potential effects of disturbance to mountain goats. Of the 50 parcels identified as potential replacement habitat for mitigating the effects of the proposed project, 11 may provide mountain goat habitat. The combined mine-transmission line alternatives are not anticipated to result in the loss of goat herd occurrence or abundance in the southern Cabinet Mountains. In all combined action alternatives, the risk of mountain goat mortality would increase as a result of increased access to mountain goat habitat.

Cumulative Effects

Neither Alternative 1 nor Alternative A would cumulatively impact mountain goats. Mineral exploration has occurred and would continue to occur throughout the Cabinet Mountains, cumulatively displacing goats from suitable habitat or reducing their ability to effectively use the available habitat. Disturbance impacts to mountain goats from the combined action alternatives would be compounded when impacts from other reasonably foreseeable actions are taken into account. The Wayup Mine/Fourth of July Road Access Project, the Rock Creek Project, and the Bear Lakes Access Project would collectively influence about 4,561 acres of MS 1 goat habitat, potentially resulting in this habitat becoming less desirable or less effective for mountain goats.

Some of the disturbance associated with construction of the proposed project and other reasonably foreseeable actions, such as blasting and helicopter line stringing and construction, would be short-term. Noise generated by construction and blasting for the evaluation adits for the Rock Creek Project would occur sporadically for several weeks. Underground blasting would be considered after the adit reaches a depth of about 500 feet at the Rock Creek site, based on experience at the Troy Mine adit. If surface blasting and other construction activities occurred concurrently for the Rock Creek and Montanore projects, cumulative noise disturbance could result in habitat displacement and increased stress levels for mountain goats.

While cumulative disturbance impacts to goats would be mostly short-term, disturbance during project operations, such as noise and human activity, would be long-term. Road access into critical goat habitat is the single biggest threat to goats in the Cabinet Mountains (Joslin 1980), and the Fourth of July proposal would construct a new road to the edge of the Cabinet Wilderness and MS 1 habitat. Cumulative long-term disturbance to mountain goats could result in changes in seasonal habitat use, potentially causing goats to shift their use of habitat in Ramsey Creek (Alternative 2B only), Libby Creek (all combined action alternatives), upper West Fisher Creek and Rock Creek basins. These potential changes in seasonal habitat use could increase the use of unaffected summer ranges creating potential conflicts with resident goats in the CMW. The cumulative disturbance effects of the mine alternatives and other reasonably foreseeable actions could result in reduced reproductive rates and a decrease in population of the Rock Creek herd. Some cumulative human-caused disturbance effects would be offset by road access changes (installation of barriers and gates and public access restrictions) and habitat acquisitions planned as mitigation for the Montanore, Rock Creek, and other projects.

3.24.3.4.4 Regulatory/Forest Plan Consistency

KFP. The KFP does not provide specific direction for mountain goats. In all combined mine-transmission line alternatives, adequate amounts of mountain goat habitat would continue to be

provided for mountain goats. All combined mine-transmission line alternatives would be consistent with KFP direction on MIS (KFP Vol. I, II-1 #3 and #7).

Summary Alpine Forest MIS Statement. Based on the analysis for mountain goat and the KNF Conservation Plan (Johnson 2004a), in all action alternatives, habitat for alpine forest species would be provided in sufficient quality and quantity of the diverse age classes of vegetation needed for viable populations. In all action alternatives, sufficient alpine habitat would be available; the populations of species using that habitat should remain viable.

3.24.3.5 Pileated Woodpecker

3.24.3.5.1 Analysis Area and Methods

The pileated woodpecker is a MIS for old growth and snag habitat in the KNF. Old growth habitat is optimal for pileated woodpecker, providing both nesting habitat and year-round foraging habitat (Thomas 1979). Large diameter snags characteristically found in old growth forests provide nesting habitat for the pileated woodpecker, while both the snags and coarse woody material provide habitat for the woodpecker's primary prey species, the carpenter ant (Warren 1990).

Pileated woodpecker population ecology, biology, habitat description, and relationships in the northern Rocky Mountains are described in McClelland and McClelland (1999), McClelland (1979, 1977), McClelland *et al.* (1979), and Warren (1990). This information is incorporated by reference. Research conducted in the Pacific and Inland Northwest is described in Bull and Jackson (1995), Bull and Holthausen (1993), Bull *et al.* (1992b), Bull (1987, 1980, 1975), Bull and Meslow (1977), Mellen *et al.* (1992), Mellen (1987), Thomas (1979), Mannan (1977), and Jackman (1974).

Pileated woodpecker occurrence data come from recent District wildlife observation records, the Region One Landbird Monitoring Program (Avian Science Center, University of Montana), and Forest historical data (NRIS FAUNA). Potential habitat for this species on National Forest System land was estimated using all designated and undesignated old growth habitat and old growth replacement habitat that has been mapped for the KNF. On private land, potential pileated woodpecker habitat is based on old growth mapping, as described in section 3.21, *Vegetation*.

Effects of the alternatives were evaluated based on impacts to important attributes of pileated woodpecker habitat, primarily designated and undesignated old growth habitat, and the estimated number of pileated woodpeckers potentially supported in the analysis area. Availability of down wood and snag habitat, and the effects of habitat fragmentation and increased edge habitat was also evaluated. Specific features of old growth stands evaluated for project impacts on the pileated woodpecker include preferred nest tree species, preferred nest tree size, down logs (both size and quantity), basal area, and canopy closure.

The assessment of habitat quality also includes the evaluation of fragmentation, edge effect, and interior habitat discussed in section 3.21.2, *Old Growth Ecosystems*. Potential impacts of firewood cutting are also evaluated. Stands that are not designated as old growth but that may have one or more important attributes of old growth forests, or perhaps provide for connectivity and interior habitat, also were reviewed as part of this analysis.

The number of pileated woodpeckers potentially supported, referred to as potential population index (PPI), in the analysis area was estimated based on methods described in Johnson (2003).

The PPI was determined by dividing habitat acres by average home range sizes derived from McClelland (1977), Thomas (1979), Mellen *et al.* (1992), and Bull and Holthausen (1993). Research suggests that fewer acres of higher quality habitat are required to support a breeding pair of pileated woodpeckers (McClelland 1977; Mannan *et al.* 1980; Bull and Holthausen 1993). Also, allowing for larger territory sizes as habitat becomes fragmented appears reasonable, as territory sizes up to 2,600 acres have been reported for western Oregon (Mellen *et al.* 1992). Thus, the PPI in the KNF and the analysis area was calculated based on one nesting pair per 600 acres of effective old growth habitat and one nesting pair per 1,000 acres of replacement old growth habitat. The PPI was calculated based on the assumption that all currently mapped effective and replacement old growth habitat (both designated and undesignated) provides suitable nesting habitat, and that all suitable habitat is spatially distributed across the landscape in a pattern that can be incorporated into individual nesting territories.

The analysis areas for project impacts to individuals and their habitat in the KNF are the Crazy and Silverfish PSUs. The analysis area for evaluating direct and indirect impacts of the transmission line on pileated woodpeckers on private and state land consists of all non-National Forest System lands that would be disturbed by any of the transmission line alternatives. The KNF and any non-National Forest System lands potentially disturbed by the transmission line alternatives is the analysis area for cumulative effects.

The impacts analysis includes an evaluation of the potential benefits to pileated woodpeckers from mitigation measures proposed by MMC or the agencies, such as designation of old growth-associated with the agencies' proposed old growth mitigation and land acquisitions.

3.24.3.5.2 Affected Environment

Based on existing old growth (see section 3.21, *Vegetation*), the estimated minimum PPI for the pileated woodpecker on the KNF is 430 nesting or breeding pairs. This is within the calculated historical range of variation (HRV) for the minimum potential population index of 335 to 554 breeding pairs (Johnson 1999).

A detailed summary of old growth habitat for the Crazy and Silverfish PSUs is provided in section 3.21, *Vegetation*. The Crazy PSU contains about 8,620 acres of effective old growth habitat (both designated and undesignated), and the Silverfish PSU contains about 5,271 acres of effective old growth habitat (both designated and undesignated). The Crazy PSU contains about 477 acres of replacement old growth habitat (both designated and undesignated), and the Silverfish PSU contains about 1,361 of replacement old growth habitat (both designated and undesignated). Existing pileated woodpecker nesting territories likely encompass a significant portion of this old growth habitat. Based on the quantity of old growth habitat available, the Crazy PSU could support about 12 nesting territories (PPI) and the Silverfish PSU could support about 11 nesting territories (PPI).

Snags and down wood provide food resources such as carpenter ants and their larvae, one of the primary prey items for pileated woodpeckers in the Northern Rockies (McClelland and McClelland 1999; McClelland 1977) and in the Pacific and Inland Northwest (Bull *et al.* 1992a; Bull 1987, 1975; Bull *et al.* 1980). Existing snag densities and amounts of down wood in the Crazy and Silverfish PSUs are greater than KFP-recommended levels. Existing conditions for snag habitat and down wood are described in section 3.24.2, *Key Habitats*.

No population data are available for pileated woodpeckers within the KNF. During breeding bird point count surveys conducted from 1994 to 2004 on the KNF, the pileated woodpecker was observed 204 times at the 2,638 individual survey points (USDA Forest Service 2003b). Point count surveys are not designed to census woodpecker species and may not accurately reflect pileated woodpecker populations. No pileated woodpeckers were observed during breeding bird surveys conducted in 2005 at the Little Cherry Creek Tailings Impoundment Site, the Ramsey Plant Site, the LAD Areas, and MMC's proposed transmission line alignment (Westech 2005a). Searches for active pileated woodpecker nest cavities also were conducted during old growth validation surveys in 2007, but none were found (see KNF project record).

Potential pileated woodpecker habitat on private and state lands within the analysis area consists primarily of riparian old growth and occurs mainly in the Fisher River, West Fisher Creek, and Hunter Creek riparian corridors.

3.24.3.5.3 Environmental Consequences

The following section discusses the direct, indirect, and cumulative effects on pileated woodpeckers for each of the mine alternatives, transmission line alternatives, and combined mine-transmission line alternatives. Impacts to pileated woodpecker in the Crazy and Silverfish PSUs from the mine and transmission line alternatives are summarized in Table 171 and Table 172 and described below.

Alternative 1 – No Mine

In Alternative 1, natural successional processes would continue to occur throughout old growth stands and habitat would continue to be provided for pileated woodpecker nesting pairs where feeding and breeding conditions are suitable. There would be no direct or indirect impacts to pileated woodpecker (old growth habitat) from Alternative 1, and no change in PPI (Table 171).

Replacement old growth habitat currently provides less suitable stand conditions for territory occupation. Over the next several decades, in the absence of catastrophic fires or windstorms, these stands would develop habitat features suitable for pileated woodpeckers such as larger trees, larger snags, more down logs, and more dead and dying trees that provide food resources such as carpenter ants and their larvae.

In Alternative 1, continued disruption of the historical pattern of frequent fires in the drier ponderosa pine/Douglas-fir cover type would result in ecological changes, such as the encroachment of Douglas-fir saplings in the understory. Eventually, these sites would develop a higher percentage of Douglas-fir trees, snags, and down logs more suitable as foraging habitat for pileated woodpeckers. This successional trend may result in a reduction in quality pileated woodpecker nest trees (ponderosa pine) since Douglas-fir was not found to be important for pileated woodpecker nest cavity excavation in the northern Rocky Mountains (McClelland and McClelland 1999; McClelland 1977; Weydemeyer and Weydemeyer 1928), in northeast Oregon (Bull 1987, 1975; Thomas 1979), or in British Columbia (Harestad and Keisker 1989).

Table 171. Effects on Potential Pileated Woodpecker Habitat and Population Index by Mine Alternative.

Analysis Area	[1] No Mine/ Existing Con-ditions	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impound-ment Alternative	[4] Agency Mitigated Little Cherry Creek Impound-ment Alternative
Crazy PSU				
Unmitigated Effects				
Effective OG (acres)	7,206	6,902 (-304)	7,026 (-180)	7,034 (-172)
Replacement OG (acres)	239	236 (-3)	236 (-3)	236 (-3)
PPI	12	12	12	12
Mitigated Effects				
Total old growth designated (acres)[1]	0	0	587	659
PPI with mitigation[2]	12	12	13	13
KNF				
Unmitigated Effects				
Effective OG (acres)	199,109	198,805 (-304)	198,929 (-180)	198,937 (-172)
Replacement OG (acres)	98,064	98,061 (-3)	98,061 (-3)	98,061 (-3)
PPI	430	430	430	430
Mitigated Effects				
PPI with mitigation[2]	430	430	431	431

OG = old growth.
Number in parentheses is the reduction in habitat acres due to the alternative compared to Alternative 1 No Mine/Existing Conditions.
Mine alternatives would not impact potential pileated woodpecker habitat (old growth) in the Silverfish PSU and are not shown.
[1] Old growth designated to mitigate impacts to old growth. See section 3.21, *Vegetation* for a more detailed description of old growth mitigation.
[2]PPI with mitigation is based on the assumption that old growth is designated in association with mitigation provides replacement old growth.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 172. Effects on Potential Pileated Woodpecker Habitat and Population Index by Transmission Line Alternative.

Analysis Area and Indicator	[A] No Transmission Line/Existing Conditions	[B] MMC's Proposed Transmission Line (North Miller Creek Alternative) (Change from Existing Conditions)	[C] Modified North Miller Creek Transmission Line (Change from Existing Conditions)	[D] Miller Creek Transmission Line (Change from Existing Conditions)	[E] West Fisher Creek Transmission Line (Change from Existing Conditions)
Crazy PSU[1]					
Unmitigated Effects					
Effective OG (acres)	7,206	7,183 (-23)	7,198 (-8)	7,193 (-13)	7,193 (-13)
Replacement OG (acres)	239	239 (0)	239 (0)	239 (0)	239 (0)
PPI	12	12	12	12	12
Crazy and Silverfish PSUs					
Mitigated Effects					
Total old growth designated (acres)[2]	0	0	39	64	64
Combined Crazy and Silverfish PPI[2]	23	23	23	23	23
KNF					
Unmitigated Effects					
Effective OG (acres)	199,109	199,086 (-23)	199,101 (-8)	199,096 (-13)	199,096 (-13)
Replacement OG (acres)	98,064	98,064 (0)	98,064 (0)	98,064 (0)	98,064 (0)
PPI	430	430	430	430	430
Mitigated Effects					
PPI with mitigation[3]	430	430	430	430	430
Private Land					
Old growth removed (acres)	0	4	2	2	6

See footnotes on next page.

OG = old growth.
Number in parentheses is the reduction in habitat acres due to the alternative compared to Alternative A, No Transmission Line/Existing Conditions.
[1] Impacts of the transmission line alternatives on potential pileated woodpecker habitat (old growth) in the Silverfish PSU would be limited to edge effects to 2 acres of old growth and a loss of 2 acres of interior old growth for Alternatives 3E and 4E (see section 3.21, *Vegetation*) and are not shown.
[2] Old growth designated to mitigate impacts to old growth. See section 3.21, *Vegetation* for a more detailed description of old growth mitigation.
[3] PPI with mitigation based on assumption that old growth designated in association with mitigation provides replacement old growth.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Alternative 2 – MMC's Proposed Mine

As shown in Table 171, Alternative 2 would affect about 304 acres of effective old growth habitat and 3 acres of replacement old growth habitat in the Crazy PSU, reducing nesting and foraging habitat and habitat quality for the pileated woodpecker. No effective or replacement old growth would be directly affected by Alternative 2 in the Silverfish PSU or on private or state land east of the Silverfish PSU. Direct impacts to old growth resulting from Alternative 2 would be too small to change the existing PPI. Alternative 2 would result in edge effects to about 125 acres of old growth habitat and a loss of about 443 acres of interior, potentially reducing the capacity of remaining old growth stands to support the pileated woodpecker or some of the old growth-associated wildlife species it represents. The majority of impacts to potential pileated woodpecker habitat would occur in Little Cherry Creek Impoundment and LAD Area 2 at the mouth of Ramsey and Poorman creeks, reducing habitat connectivity between these drainages. Several old growth blocks would be reduced in size, diminishing their capacity to support pileated woodpeckers. The Alternative 2 tailings impoundment would result in the loss of 197 acres of old growth in one localized area, which could displace one or more nesting pairs that may have traditionally used the area. Old growth impacts associated with Alternative 2 could include the removal of a nest tree or night winter roost tree used by the pileated woodpecker or some of the old growth-associated wildlife species it represents. Impacts to old growth habitat are described in section 3.21.2, *Old Growth Ecosystems*. Loss of old growth providing potential pileated woodpecker habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels and acquired parcels could be managed to benefit pileated woodpeckers. As described in section 3.24.2, *Key Habitats*, Alternative 2 would result in the loss of snags greater than 20 inches diameter at breast height (dbh) and down logs greater than 10 inches dbh that provide potential nesting and foraging habitat for pileated woodpeckers. Snag densities and quantities of down wood would remain greater than KNF-recommended levels and would continue to be sufficient to sustain viable populations of cavity-dependent species in the KNF. Snag losses would not likely increase due to roads constructed for Alternative 2 because these roads would be closed to the public.

According to recommendations provided by McClelland (1979) and McClelland *et al.* (1979), riparian old growth habitat in the northern Rocky Mountains should be at least 300 feet in width to meet pileated woodpecker habitat requirements. Although MMC's proposed Wetland Mitigation Plan (see section 2.4.6.1, *Wetland Mitigation Plan*) would be implemented, construction of the impoundment, roads, bridges, and other mine facilities associated with Alternative 2 would disturb about 37 acres of wetland and riparian habitat and could contribute to habitat fragmentation. Impacts to riparian habitat are described in section 3.21, *Vegetation*.

Noise and other human-caused disturbances, such as blasting, construction of the plant and adit sites, road construction and use, and plant and adit operations could cause pileated woodpeckers to avoid nearby habitat, at least temporarily. Disturbance impacts would likely be greatest during the construction phase, but could persist through mine operations.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Direct impacts of Alternative 3 on old growth habitat potentially supporting pileated woodpeckers would be similar to Alternative 2, except that Alternative 3 would affect less old growth. About 180 acres of effective habitat and 3 acres of replacement habitat in the Crazy PSU would be disturbed in Alternative 3 (Table 171). Direct impacts to old growth resulting from Alternative 3 would be too small to change the existing PPI. Alternative 3 would result in edge effects to about 167 acres of old growth habitat and a loss of about 356 acres of interior, potentially reducing the capacity of remaining old growth stands to support the pileated woodpecker or some of the old growth-associated wildlife species it represents. The majority of impacts to designated old growth would occur as a result of the Poorman Impoundment construction or in LAD Area 2 at the mouth of Ramsey and Poorman creeks, reducing habitat connectivity between these drainages. Several old growth blocks would be reduced in size, diminishing their capacity to support pileated woodpeckers. The Alternative 3 tailings impoundment would result in the loss of 154 acres of old growth in one localized area, which could displace one or more nesting pairs that may have traditionally used the area. Old growth impacts associated with Alternative 3 could include the removal of a nest tree or night winter roost tree used by the pileated woodpecker or some of the old growth-associated wildlife species it represents.

As described in section 3.21, *Vegetation*, the agencies' mitigation in Alternative 3 would include the designation of 587 acres of additional old growth on National Forest System lands. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics, potentially improving the quality of habitat for pileated woodpeckers. Loss of old growth providing potential pileated woodpecker habitat also may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels and acquired parcels could be managed to benefit pileated woodpeckers.

Construction of the impoundment, roads, bridges, and other mine facilities associated with Alternative 3 would result in the disturbance of about 14 acres of wetland and riparian habitat and could contribute to habitat fragmentation. Impacts to wetlands and riparian areas would be minimized through implementation of the agencies' Wetland Mitigation Plan and Vegetation Removal and Disposition Plan (sections 2.5.7.1, *Wetland Mitigation* and 2.5.3.2.1, *Vegetation Removal and Disposition*), and the Environmental Specifications (Appendix D). As described in sections 2.5.7.1, *Wetland Mitigation* and 2.5.3.2.1, *Vegetation Removal and Disposition*, all wetlands affected would be replaced with wetlands with similar functions and values. Impacts to riparian habitat are described in section 3.21, *Vegetation*. Impacts from noise and human activities associated with Alternative 3 would be similar to Alternative 2.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts of Alternative 4 on old growth habitat potentially supporting pileated woodpeckers would be similar to Alternative 2, except that Alternative 4 would affect less old growth. Alternative 4 would affect about 172 acres of effective habitat, and 3 acres of replacement habitat in the Crazy

PSU (Table 171), edge effects to about 167 acres of old growth habitat, and a loss of about 356 acres of interior habitat.

Impacts of Alternative 4 on riparian habitat potentially supporting pileated woodpeckers would be the same as Alternative 3. Impacts from noise and human activities associated with Alternative 4 would be similar to Alternatives 2 and 3.

The Alternative 4 tailings impoundment would result in the loss of 151 acres of old growth in one localized area, which could displace one or more nesting pairs that may have traditionally used the area. Old growth impacts associated with Alternative 4 could include the removal of a nest tree or night winter roost tree used by the pileated woodpecker or some of the old growth-associated wildlife species it represents.

As described in section 3.21, *Vegetation*, Alternative 4 would include the designation of 659 acres additional old growth on National Forest System lands. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics, potentially improving the quality of habitat for pileated woodpeckers. Also, loss of old growth providing potential pileated woodpecker habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels and acquired parcels could be managed to benefit pileated woodpeckers.

Alternative A – No Transmission Line

There would be no impacts to pileated woodpecker (old growth habitat) from Alternative A, and no change in PPI (Table 172).

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

As shown in Table 172, Alternative B would affect about 23 acres of effective habitat in the Crazy PSU. No replacement old growth would be impacted in the Crazy PSU, and no old growth in the Silverfish PSU would be directly affected by Alternative B. Physical removal of old growth resulting from Alternative B would be too small to change the existing PPI. Alternative B would result in edge effects to about 102 acres of old growth habitat and a loss of about 127 acres of interior old growth habitat, potentially reducing the capacity of remaining old growth stands to support the pileated woodpecker or some of the old growth-associated wildlife species it represents. Alternative B would remove about 4 acres of old growth habitat on private land along the Fisher River and a short portion of Miller Creek. The majority of impacts to old growth would occur in the Ramsey Creek corridor and at the confluence of Libby and Howard creeks, reducing habitat connectivity in these drainages. Reducing the size of old growth blocks would diminish their capacity to support pileated woodpeckers. Loss of old growth providing potential pileated woodpecker habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels and they could be managed to benefit pileated woodpeckers.

As described in section 3.24.2, *Key Habitats*, Alternative B would result in the loss of snags greater than 20 inches dbh and down logs greater than 10 inches dbh that provide potential nesting and foraging habitat for pileated woodpeckers. Snag densities and quantities of down wood would remain greater than KNF-recommended levels and would continue to be sufficient to sustain viable populations of cavity-dependent species in the KNF. Snag losses would not likely

increase due to roads constructed for Alternative B because these roads would be closed to the public.

According to recommendations provided by McClelland (1979) and McClelland *et al.* (1979), riparian old growth habitat in the northern Rocky Mountains should be at least 300 feet in width to meet pileated woodpecker habitat requirements. Although the clearing area for Alternative B would include about 13 acres of wetlands and riparian habitat, impacts to wetlands and riparian areas would be minimized through implementation of MMC's proposed Wetland Mitigation Plan (see section 2.4.6.1, *Wetland Mitigation Plan*), and the Environmental Specifications (Appendix D). Impacts to riparian habitat are described in section 3.21, *Vegetation*.

Noise from helicopters during line stringing could cause pileated woodpeckers to avoid nearby habitat, at least temporarily. Similar effects could occur from other transmission line construction activities in areas where helicopters were not used, and would be more extensive for Alternative B than the agencies' alternatives. Disturbance impacts would be short-term and, with the exception of line maintenance activities, would cease after transmission line construction until decommissioning. Helicopter use and other activities would cause similar disturbances with similar durations during line decommissioning.

Alternative C – Modified North Miller Creek Transmission Line Alternative

Alternative C would have similar physical impacts to pileated woodpecker habitat as Alternative B, except that less effective old growth would be disturbed in the Crazy PSU. As shown in Table 172, Alternative C would affect about 8 acres of effective habitat in the Crazy PSU. Physical removal of old growth resulting from Alternative C would be too small to change the existing PPI. Alternative C would result in edge effects to about 23 acres of old growth habitat and a loss of about 51 acres of interior on KNF lands, reducing the capacity of remaining old growth stands to support pileated woodpeckers. Reducing the size of old growth blocks would diminish their capacity to support pileated woodpeckers. The majority of impacts to old growth would occur at the confluence of Libby and Howard creeks, reducing habitat connectivity between these drainages. Alternative C would remove about 2 acres of old growth habitat on private land where the transmission line crossed the Fisher River.

As described in section 3.21, *Vegetation*, Alternative C would include the designation of 39 acres of additional old growth on National Forest System lands. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics, potentially improving the quality of habitat for pileated woodpeckers. Impacts to old growth on non-National Forest System lands would be minimized through implementation of the Environmental Specifications (Appendix D) and Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*). Loss of old growth providing potential pileated woodpecker habitat may also be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels.

Impacts to snag habitat from Alternative C would be the same as Alternative B.

Although the clearing area for Alternative C would include about 5 acres of wetlands and riparian habitat, impacts to wetlands and riparian areas would be minimized through implementation of the agencies' Wetland Mitigation Plan and Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*), and the Environmental Specifications (Appendix

D). Impacts to riparian habitat are described in section 3.21, *Vegetation*. Noise and other human-caused disturbance to pileated woodpeckers would be the same for Alternative C as Alternative B, except that helicopter disturbance during construction could last up to 2 months longer where helicopters were used for clearing and line construction, and other construction activities in areas where helicopters were not used would be less extensive than for Alternative B.

Alternative D – Miller Creek Transmission Line Alternative

Impacts of Alternative D on old growth habitat potentially supporting pileated woodpeckers would be similar to Alternative C, except that Alternative D would result in slightly more direct impacts and edge effects to old growth. As shown in Table 172, Alternative D would affect about 13 acres of effective habitat in the Crazy PSU, edge effects to about 38 acres of old growth habitat, and a loss of about 52 acres of interior habitat. Mitigation measures would be the same for Alternative D as Alternative C, except that Alternative D would include the designation of 64 acres of additional old growth on National Forest System lands. Impacts to snag habitat from Alternative D would be the same as Alternative B.

Although the clearing area for Alternative D would include about 14 acres of wetlands and riparian habitat, impacts to wetlands and riparian areas would be minimized through implementation of the agencies' Wetland Mitigation Plan and Vegetation Removal and Disposition Plan (sections 2.5.7.1, *Wetland Mitigation* and 2.5.3.2.1, *Vegetation Removal and Disposition*), and the Environmental Specifications (Appendix D). Impacts to riparian habitat are described in section 3.21, *Vegetation*. Noise and other human-caused disturbance to pileated woodpeckers would be the same for Alternative D as Alternative B.

Alternative E – West Fisher Creek Transmission Line Alternative

Direct impacts to pileated woodpecker habitat from Alternative E would be the same as Alternative D, except that less wetland and riparian habitat would be affected. Although the clearing area for Alternative E would include about 11 acres of wetlands and riparian habitat, impacts to wetlands and riparian areas would be minimized through implementation of the agencies' Wetland Mitigation Plan and Vegetation Removal and Disposition Plan (sections 2.5.7.1, *Wetland Mitigation* and 2.5.3.2.1, *Vegetation Removal and Disposition*), and the Environmental Specifications (Appendix D). Impacts to riparian habitat are described in section 3.21.1.3.3, *Wetlands and Riparian Areas*.

Alternative E would directly impact about 6 acres of old growth habitat on private and state land where the transmission line crossed the Fisher River and parallel West Fisher Creek. Mitigation of impacts to old growth on private and state land would be the same as Alternative D. Noise and other human-caused disturbance to pileated woodpeckers would be the same for Alternative E as Alternative B.

Combined Mine-Transmission Line Effects

Impacts to pileated woodpecker in the Crazy PSU from the combined mine-transmission line alternatives are summarized in Table 173. Impacts of the combined mine and transmission line alternatives on potential pileated woodpecker habitat (old growth) in the Silverfish PSU would be limited to edge effects to 2 acres of old growth and a loss of 2 acres of interior old growth for Alternatives 3E and 4E and are not shown in Table 173.

Table 173. Effects on Potential Pileated Woodpecker Habitat and Population Index by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] No Mine Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Alternative		
		TL-B	TL-C	TL-D	TL-E	TL-C	TL-D	TL-E
Crazy PSU								
Unmitigated Effects								
Effective OG (acres)	7,206	6,884 (-322)	7,018 (-188)	7,013 (-193)	7,013 (-193)	7,026 (-180)	7,021 (-185)	7,021 (-185)
Replacement OG (acres)	239	236 (-3)	236 (-3)	236 (-3)	236 (-3)	236 (-3)	236 (-3)	236 (-3)
PPI	12	12	12	12	12	12	12	12
Mitigated Effects								
Total old growth designated (acres)[1]	N/A	0	626	651	651	698	723	723
PPI with mitigation[2]	N/A	12	13	13	13	13	13	13
KNF								
Unmitigated Effects								
Effective OG (acres)	199,109	198,787 (-322)	198,921 (-188)	198,916 (-193)	198,916 (-193)	198,929 (-180)	198,924 (-185)	198,924 -(185)
Replacement OG (acres)	98,064	98,061 (-3)	98,061 (-3)	98,061 (-3)	98,061 (-3)	98,061 (-3)	98,061 (-3)	98,061 (-3)
PPI	430	429	430	430	430	430	430	430
Mitigated Effects								
PPI with mitigation[2]	N/A	429	431	431	431	431	431	431
Private Land								
Old growth removed (acres)	N/A	4	2	2	2	2	2	2

OG = old growth.

Number in parentheses is the reduction in habitat acres due to the alternative compared to Alternative 1, No Mine/Existing Condition.

Impacts of the combined mine-transmission line alternatives on potential pileated woodpecker habitat (old growth) in the Silverfish PSU would be limited to edge effects to 2 acres of old growth and a loss of 2 acres of interior old growth for Alternatives 3E and 4E (see section 3.21, *Vegetation*) and are not shown.

[1] Old growth designated to mitigated impacts to old growth. See section 3.21, *Vegetation* for a more detailed description of old growth mitigation.

[2] PPI with mitigation based on assumption that old growth designated in association with mitigation provides replacement old growth.

Source: GIS analysis by ERO Resources Corp. using KNF data.

Impacts to old growth providing potential pileated woodpecker habitat from combined mine-transmission line alternatives would be the greatest for MMC's proposed alternative (Alternative 2B). Alternative 2B would directly impact 225 acres of old growth, increase edge by 227 acres, and decrease interior habitat by 570 acres. Direct impacts to old growth from the combined agencies' alternatives (Alternatives 3C, 3D, 3E, 4C, 4D, and 4E), including impacts on private and state land, would range from 185 acres to 202 acres. Combined agencies' alternatives would increase edge by between 150 acres for Alternative 4C and 205 acres for Alternatives 3D and 3E. For all combined action alternatives, the tailings impoundment would result in the loss of 151 to 197 acres of old growth in one localized area, which could displace one or more nesting pairs that may have traditionally used the area. Old growth impacts associated with all combined action alternatives could include the removal of a nest tree or night winter roost tree used by the pileated woodpecker or some of the old growth-associated wildlife species it represents. Impacts to old growth from the combined mine-transmission line alternatives are described in section 3.21.2, *Old Growth Ecosystems*. Loss of old growth providing potential pileated woodpecker habitat may be offset.

The combined action alternatives would affect between 2 and 6 acres of old growth on private and state land. Impacts to old growth on private land would be minimized through implementation of the Environmental Specifications and, for the combined agencies' alternatives, the Vegetation Removal and Disposition Plan described in section 2.5.3.2.1, *Vegetation Removal and Disposition*.

As described in section 3.24.2, *Key Habitats*, all combined action alternatives would result in the loss of snags greater than 20 inches dbh and down logs greater than 10 inches dbh that provide potential nesting and foraging habitat for pileated woodpeckers. In all combined mine-transmission line alternatives, snag densities and quantities of down wood would remain greater than KNF-recommended levels and would continue to be sufficient to sustain viable populations of cavity-dependent species in the KNF. Snag losses would not likely increase due to roads constructed for the combined action alternatives because these roads would be closed to the public.

Although all combined action alternatives would affect wetland and riparian areas, impacts would be minimized through implementation of MMC's proposed Wetland Mitigation Plan, the agencies' Wetland Mitigation Plan and Vegetation Removal and Disposition Plan (see sections 2.5.7.1, *Wetland Mitigation* and 2.5.3.2.1, *Vegetation Removal and Disposition*), and the Environmental Specifications (Appendix D). As described in sections 2.5.7.1, *Wetland Mitigation* and 2.5.3.2.1, *Vegetation Removal and Disposition*, all wetlands affected would be replaced with wetlands with similar functions and values. Impacts to riparian habitat are described in section 3.21.1.3.3, *Wetlands and Riparian Areas*.

In all combined action alternatives, noise from helicopters during line stringing and from other construction-related activities may cause pileated woodpeckers to avoid nearby habitat, at least temporarily. Disturbance impacts from blasting and helicopters would be short-term and, with the exception of line maintenance activities, would cease after transmission line construction until decommissioning. Disturbance from helicopter use and other transmission line construction activities are described for Alternatives B and C above. Disturbance impacts during mine operations would probably be lower in intensity, but would last through the life of the mine.

As described in section 3.21, *Vegetation*, the agencies' alternatives would include the designation of between 626 and 723 acres of additional old growth on National Forest System lands (see section 3.21, *Vegetation*), potentially improving habitat for an additional breeding pair of pileated woodpeckers. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics, potentially improving habitat quality for pileated woodpeckers. For all combined action alternatives, impacts to old growth on private land would be minimized through implementation of the Environmental Specifications (Appendix D) and Vegetation Removal and Disposition Plan described in section 2.5.3.2.1, *Vegetation Removal and Disposition*. In all combined action alternatives, losses and degradation of providing potential pileated woodpecker habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels and they could be managed to benefit pileated woodpeckers.

Cumulative Effects

Past actions, particularly timber harvest, road construction, and fire-suppression activities, have altered the old growth ecosystems in the analysis area, resulting in a reduction in early and late succession habitats; conditions favoring shade-tolerant, fire-intolerant species; loss of large snags and down wood; and increases in tree density and a shift to a largely mid-seral structural stage (USDA Forest Service 2003b). Firewood cutting would continue to occur where open roads provided access to old growth habitat, contributing removal of snags important to pileated woodpeckers. Continuing development of private lands, including timber harvest, home construction, and land clearing, would contribute to losses of pileated woodpecker habitat in the analysis area. Impacts to pileated woodpecker on private and state lands would probably be minimal because it is likely that limited amounts of old growth occur on private and state lands, based on past and current harvest practices.

Regeneration harvest included in the Miller-West Fisher Vegetation Management Project, which would occur in the Silverfish PSU, would not directly affect old growth providing potential pileated woodpecker habitat. The Miller-West Fisher Vegetation Management Project would result in minor increased edge effects where regeneration harvest is proposed adjacent to old growth. While the combined action alternatives, in combination with other past, current, and reasonably foreseeable actions, would result in some losses and degradation of pileated woodpecker habitat, cumulative impacts on overall amounts of old growth would likely be minimal. In addition, mitigation associated with combined agencies' alternatives would increase the proportion of designated old growth and promote the maintenance or development of pileated woodpecker habitat in the analysis area.

Cumulative noise and other human-caused disturbances could occur as a result of the combined action alternatives and other reasonably foreseeable actions. Cumulative disturbance effects could affect individual pileated woodpeckers, but would not likely affect pileated woodpecker populations in the KNF.

3.24.3.5.4 Regulatory/Forest Plan Consistency

All action alternatives would require a project-specific amendment to allow harvest within designated old growth stands (MA 13) (see 3.14.2.2, *Methods*). The project-specific amendment would change the current MA 13 (Old Growth) allocation of all harvested stands to either MA 23 (Electric Transmission Corridor) or MA 31 (Mineral Development). All action alternatives would

be consistent with KFP direction to maintain a minimum of 10 percent old growth below 5,500 feet in elevation in each third order drainage or compartment, or a combination of compartments.

Analysis of old growth forest-wide (USDA Forest Service 2007d) concludes that at least 10 percent of the KNF below 5,500 feet is managed as old growth, as required in the KFP. Specifically, National Forest System lands below 5,500 feet include 297,173 acres (15.9 percent) of old growth or replacement old growth. About 10.7 percent (199,109 acres) of those lands were determined to be effective old growth, and 5.2 percent (98,064 acres) were identified as replacement old growth.

The action alternatives would result in between 16.4 and 18.2 percent designated old growth below 5,500 feet elevation in the Crazy PSU, and 12.9 percent designated old growth below 5,500 feet elevation in the Silverfish PSU. The KFP established that maintaining 10 percent of old growth habitat is sufficient to support viable populations of old-growth dependent species (KFP Vol. 1, II-1 #7 and III-54; Vol. 2, A-17).

All action alternatives would be consistent with KFP direction for snags and down wood (see section 3.24.2, *Key Habitats*). In all combined mine-transmission line alternatives, a wide range of successional habitats and associated amounts of down wood would be available. The action alternatives would be consistent with KFP direction to maintain diverse age classes of vegetation for viable populations (KFP II-1 #7).

Summary Old Growth, Snag and Down Wood Habitat MIS Statement. Based on the analysis for pileated woodpecker and the KNF Conservation Plan (Johnson 2004a), in all action alternatives, habitat for old growth forest species and cavity habitat users would be provided in sufficient quality and quantity of the diverse age classes of vegetation needed for viable populations. In all action alternatives, sufficient old growth forest, and snag and down wood habitat would be available; the populations of species using that habitat should remain viable.

3.24.3.6 Irreversible and Irretrievable Commitments

There would be no irreversible commitments of MIS habitat due to any of the action alternatives.

Irretrievable commitments of elk, white-tailed deer, mountain goat, and pileated woodpecker habitat would occur in the Crazy and Silverfish PSUs due to decreases in cover, increases in road densities, decreases in habitat security, decreases in habitat effectiveness, habitat losses, and increases in disturbance associated with the action alternatives. For the action alternatives, recovery of habitat security and habitat effectiveness, and reduction of ORD to pre-mine conditions would not occur until after mine closure and reclamation. For the transmission line alternatives, recovery of deer and elk habitat would be quicker, and would begin after transmission line construction.

3.24.3.7 Short-term Uses and Long-term Productivity

Most losses of cover, increases in road densities, decreases in habitat security, decreases in habitat effectiveness, and increases in disturbance associated with the mine alternatives would last until mine closure and reclamation. Most human-caused disturbance effects on mountain goat habitat would occur only during blasting; some disturbance effects from mine operations would last until mine closure. For the transmission line alternatives, increases in road densities, decreases in habitat security, decreases in habitat effectiveness, and human-caused disturbance of deer, elk,

mountain goats, and pileated woodpecker would be short-term, and would last until the transmission line was built.

3.24.3.8 Unavoidable Adverse Environmental Effects

Unavoidable adverse effects would occur from all action alternatives in the Crazy and Silverfish PSUs where new roads were constructed, gated or barriered roads were opened, mine and transmission line facilities were built, and mine operations occurred.

3.24.4 Forest-Sensitive Species

3.24.4.1 Regulatory Framework

Section 3.6, *Aquatic Life and Fisheries* discusses the regulatory framework for forest-sensitive species. Sensitive wildlife species on the KNF are listed in Table 174. State wildlife Species of Concern are discussed in section 3.24.7, *Other Species of Interest*. Bald eagles are also protected by two federal laws: the Bald and Golden Eagle Protection Act (Eagle Act) and the Migratory Bird Treaty Act (MBTA). The Eagle Act, originally passed in 1940, prohibits the "take, possession, sale, purchase, barter, offer to sell, purchase, or barter, transport, export, or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit" (16 U.S.C. 668(a); 50 CFR 22). "Take" is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb." The term "disturb" under the Eagle Act is defined as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior" (72 Fed. Reg. 31332).

3.24.4.2 Bald Eagle

3.24.4.2.1 Analysis Area and Methods

Eagle population ecology, biology, habitat description, and relationships identified by research are described in Montana Bald Eagle Working Group (MBEWG) (1991, 1994); USFWS (1995, 1999); and USFWS (2007a). That information is incorporated by reference. Eagle occurrence data come from recent District wildlife observation records, Forest historical data (NRIS FAUNA), KNF monitoring data (USDA Forest Service 2005c), and other agencies (USFWS, FWP).

The National Bald Eagle Management Guidelines (NBEMG) (USFWS 2007b) provide recommendations for avoiding disturbance to bald eagles, and also encourages the continued development and use of state-specific management plans. The Montana Bald Eagle Management Plan (MBEMP) (MBEWG 1991, 1994) states that the Plan "will also serve as the conservation and management plan when bald eagles are delisted." The guidelines provided in the MBEMP meet the recommendations from the NBEMP; therefore, effects of project alternatives on potential eagle habitat and any known eagle nests are evaluated based on whether or not they meet guidelines from the MBEMP.

Table 174. Sensitive Wildlife Species on the KNF.

Sensitive Species	Status In Analysis Area*	Comments**
Bald Eagle (*Haliaeetus leucocephalus*)	K	
Black Backed Woodpecker (*Picoides arcticus*)	S	2
Coeur d'Alene Salamander (*Plethodon vandykei idahoensis*)	S	
Common Loon (*Gavia immer*)	K	4
Fisher (*Martes pinnanti*)	K	
Flammulated Owl (*Otus flammeolus*)	K	
Harlequin Duck (*Histrionicus histrionicus*)	NS	2
Northern Bog Lemming (*Synaptomys borealis*)	NS	1, 2, 3
Northern Leopard Frog (*Rana pipiens*)	NS	2
Peregrine Falcon (*Falco peregrinus*)	NS	2, 4
Townsend's Big-eared Bat (*Corynorhinus townsendii*)	K	
Western Toad (*Bufo boreas*)	K	
Wolverine (*Gulo gulo*)	K	

*Status Key:
K = Species is known to occur within the analysis area.
S = Species is suspected to occur within analysis area.
NS = Species is not suspected to occur within the analysis area, and is dropped from further evaluation.
**Comment Key:
1 = Suitable habitat does not occur in the analysis area.
2 = No records in the analysis area vicinity.
3 = Analysis area is not within the known range of the species.
4 = May occur in the analysis area, but known suitable habitat would not be affected by the proposed project. Species is dropped from further analysis.
Source: Kimbell 2004, 2005; Westech 2005a; and KNF data for District observation and historical records (NRIS FAUNA).

MBEMP guidelines identify four general habitat categories and management concerns for bald eagles: nesting habitat, foraging habitat (including perch sites), winter habitat (including roost sites), and mortality risks.

Nesting habitat is typically associated with mature forest stands in close proximity (less than 1 mile) to large bodies of water, including lakes and streams, which provide an adequate prey base.

Nesting habitat includes three management zones: 1 – nest site area, 2 – primary use area, and 3 – home range. A description of each zone and associated management objectives and guidelines are found in the MBEMP (MBEWG 1994) and are included by reference. Management zones are defined as:

- Zone 1 is within 0.25 mile radius of a nest site
- Zone 2 is from 0.25 to 0.5 mile radius of nest site
- Zone 3 is suitable foraging habitat within 2.5 miles of nest site

Foraging habitat consists of lakes, rivers, wetlands, and meadows, which provide open flight paths, perches, and adequate prey. Foraging habitat also includes highway and railroad corridors (especially in the winter) where animals killed by vehicles or trains occur. Winter habitat is generally dictated by the presence and abundance of food, open water, and secure night roost sites (MBEWG 1994). Potential causes of bald eagle mortality are identified in the MBEMP (MBEWG 1994) and include shooting, accidental trapping, poisoning, diseases, and electrocution. Potential risks of vehicle collision while feeding on roadkill will also be estimated.

Guidelines for avoiding disturbance to bald eagles specified in the MBEMP (MBEWG 1991, 1994) include:

- No additional human activity, including low-intensity activity, within the nest site area during the breeding season (February 1 to August 15).
- No high intensity activities or construction of permanent developments within primary use area during the breeding season.
- No overhead utility lines or other hazards constructed within primary use area.
- Minimization of disturbance, habitat alteration, and hazards within home range.
- No human activity within 0.25 mile of high use winter perches or winter concentration areas from sunset until mid-morning. Human activity distance may be adjusted according to site-specific conditions.
- No human activity within 0.25 mile of critical and vital roosts during fall, winter, and spring use periods, as defined by the MBEMP (MBEWG 1994).

The analysis area for project impacts and cumulative effects to individuals and their habitat is all lands within the Crazy and Silverfish PSUs within the bald eagle habitat area boundaries agreed to by the USFWS (USFWS 2001); alternative disturbance within 0.5 mile of a nest site; and alternative disturbance in wetland or aquatic habitat within 2.5 miles of a nest site. This area includes the Sedlak Park Substation and loop line.

The impacts analysis includes an evaluation of the potential benefits to bald eagles from mitigation measures proposed by MMC or the agencies described in sections 2.5.7.3, *Wildlife Mitigation* and 2.9.4, *Wildlife Mitigation Measures* and Appendix D, such as recommendations outlined in Suggested Practices for Avian Protection on Power Lines (APLIC 2006) and Mitigating Bird Collisions with Power Lines (APLIC 1994).

3.24.4.2.2 Affected Environment

The bald eagle was removed from the federal threatened species list on August 8, 2007. It was then placed on the Forest Service Northern Region's sensitive species list for a period of 5 years.

The status of the bald eagle will then be reviewed to determine whether or not to retain it as a sensitive species.

Bald eagles occur as both seasonal migrants and year-round residents within the boundaries of the KNF. Based on the bald eagle habitat area boundaries agreed to by the USFWS (USFWS 2001), about 564,558 acres (242,965 acres National Forest System land, 275,470 acres private land, and 46,123 acres open water) of potential bald eagle habitat occurs in the KNF (USFWS 2001). Nesting on the KNF has increased significantly over the last 2 decades. Only one active nest was known to occur in 1978, whereas 44 pair territories (19 on National Forest System lands and 25 on private land), including 15 active nest sites on National Forest System land, were known and monitored in 2007. Nest success for active nests over the last 20-year period is about 83 percent, with an average of 1.3 fledglings per active nest (KNF bald eagle monitoring records). In early 2006, a pair of bald eagles initiated nesting at a site, known as the Silverfish nest, located along the Fisher River just north of Silver Butte Road and just west of U.S. 2 in the Silverfish PSU, about 600 feet west of MMC's proposed transmission line alignment (Figure 89). Although breeding at this nest site was not successful in 2006, two young eagles were successfully fledged from this nest in 2007. Another active nest site is located along the Fisher River on private land about 1.4 miles north of the proposed transmission line (Figure 89). Bald eagles tend to use the same breeding area, and often the same nest, each year (MBEWG 1994) and these nests are likely to be active in the future. There are no bald eagle nest sites in or near the Crazy PSU.

Several bald eagle foraging, perching, and roosting areas are located along the Fisher River in or near the Silverfish PSU. Bald eagle foraging is occasionally observed along U.S. 2 and in the major drainages in the Silverfish PSU (Bratkovich, pers. comm. 2006). In the fall, eagle use of Libby Creek is usually limited to about 8 miles upstream of its confluence with the Kootenai River.

Wintering bald eagle numbers have fluctuated depending on food sources (fish from open waters and dead animals along roads and railroad tracks) and winter conditions (open versus frozen water for foraging habitat). Mid-winter bald eagle counts throughout the KNF have averaged 96 bald eagles over the past 20 years (USDA Forest Service 2006d). Any winter use by bald eagles in the analysis area is generally limited to the U.S. 2 corridor along the eastern edge of the Silverfish PSU.

In the Silverfish PSU, there is a small risk of eagle collisions with motor vehicles traveling along U.S. 2. Because there are no highways in the Crazy PSU, the risk of mortality from vehicle collisions is low. The risk of mortality from other sources is generally low in both PSUs.

3.24.4.2.3 Environmental Consequences

This section describes the potential impacts to bald eagles from the transmission line alternatives. Impacts on bald eagle habitat are shown in Table 175 and described in the subsections below. Because the mine alternatives would not affect bald eagles, impacts from the mine alternatives and combined mine-transmission line alternatives are not discussed.

Table 175. Transmission Line Impacts on Bald Eagle Nesting Habitat and Potential Bald Eagle Habitat by Alternative.

Transmission Line Alternative	Nearest Distance to Nest Site (miles)	Nest Site Area (Zone 1)[1] (acres)	Primary Use Area (Zone 2)[2] (acres)	Home Range Foraging Area (Zone 3)[3] (acres)	Other Potential Bald Eagle Habitat[4] (acres)
A-No Action	0	0	0	0	0
B-North Miller Creek	0.10	8	9	28	103
C-Modified North Miller Creek	0.67	0	0	18	131
D-Miller Creek	0.67	0	0	18	131
E-West Fisher Creek	0.67	0	0	30	107

Transmission line disturbance area includes typical tree clearing width of 150 feet for Alternative B and 200 feet for Alternatives C, D, and E.
Areas of impact overlap between zones are not counted.
[1] Zone 1 = within 0.25 mile radius of nest site.
[2] Zone 2 = from 0.25 to 0.5 mile radius of nest site.
[3] Zone 3 = suitable foraging habitat within 2.5 miles of nest site. Foraging habitat consists of rivers, streams, and wetland areas.
[4] Other potential bald eagle habitat = all lands within the bald eagle habitat area boundaries agreed to by the USFWS (USFWS 2001).
Source: GIS analysis by ERO Resources Corp. using KNF data.

Alternative A – No Transmission Line

Alternative A would not impact bald eagle nesting, foraging, wintering, or other potential habitat and would not add to bald eagle mortality risk.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

About 4 miles of MMC's Proposed Transmission Line would have direct impacts on about 8 acres of bald eagle habitat in the nesting zone (Table 175). About 28 acres of home range foraging area for nesting bald eagles, and about 103 acres of other potential bald eagle habitat would be affected. As described in section 3.21, *Vegetation*, the clearing area for Alternative B would include about 4 acres of old growth habitat on private land along the Fisher River and a short stretch of Miller Creek. Alternative B would likely result in the clearing of large spruce and cottonwood trees in these old growth areas that provide potential bald eagle nest sites. The clearing area associated with Alternative B would be within the 660-foot buffer recommended in the NBEMG (USFWS 2007b). Bald eagles often avoid areas of high human use for nesting, foraging, perching, and roosting; they have shown a wide range of sensitivity to human disturbance (Stalmaster and Newman 1978; Knight and Knight 1984; Martell 1992; Beuhler *et al.* 1991; McCarigal *et al.* 1991). In addition to physical losses of habitat, impacts on bald eagles from Alternative B may include disturbance of breeding bald eagles and nest abandonment due to increased noise and the presence of humans and machinery. Temporary disturbance impacts from

Alternative B may also occur if increased noise and human presence associated with construction, including construction of the Sedlak Park Substation and loop line, caused eagles to avoid foraging in some areas. Disturbance impacts to bald eagles would be avoided through implementation of timing restrictions specified in the Environmental Specifications (Appendix D).

The likelihood of the 230-kV transmission line resulting in the electrocution of bald eagles or other raptors is extremely low; electrocution of raptors is primarily a problem associated with lower-voltage distribution lines (APLIC 2006). Also, electrocutions potentially caused by the transmission line would be minimized through implementation of recommendations outlined in APLIC (2006), which are based on a minimum spacing of 60 inches between phases or between phase and ground wires, and compliance with Environmental Specifications (Appendix D), including restrictions on the location of overhead utility lines. The transmission line from BPA's loop line would not pose a risk of electrocution of raptors because phase spacing would be a minimum of 20 feet.

Although raptors are generally less vulnerable to collisions with power lines than other bird species (Olendorff and Lehman 1986), the proximity of the Alternative B transmission line, including BPA's Substation and loop line, to nesting bald eagles and their foraging habitat along the Fisher River would add to the risk of bald eagle collisions with the transmission line. Potential collisions of bald eagles with the transmission line would be reduced by constructing the transmission line according to recommendations outlined in APLIC (1994) and compliance with the Environmental Specifications (Appendix D), including restrictions on the location of overhead utility lines. Applicable recommendations include locating the transmission line away from streams, mountain passes, and other potential flight corridors, placement of the lines below treeline or other topographical features, and installation of line marking devices. The latter recommendation would be particularly relevant where the transmission line paralleled and crossed the Fisher River. As discussed in section 2.9.4, *Wildlife Mitigation Measures*, areas of high risk for bird collisions where such devices may be needed, such as major drainage crossings, and recommendations for type of marking device would be identified through a study conducted by a qualified biologist and funded by MMC.

Alternative C – Modified North Miller Creek Transmission Line Alternative

Alternative C would have no direct physical impacts on bald eagle habitat in the nesting zone. About 18 acres of bald eagle foraging habitat and 131 acres of other potential habitat would be temporarily disturbed during construction of Alternative C (Table 175). As described in section 3.21, *Vegetation*, the clearing area for Alternative C would include about 2 acres of old growth habitat on private land along the Fisher River. Alternative C would likely result in the clearing of large spruce and cottonwood trees in these old growth areas that provide potential bald eagle nest sites. Temporary disturbance impacts from Alternative C could also occur if increased noise and human presence associated with construction, including construction of the Sedlak Park Substation and loop line, caused eagles to avoid foraging in some areas. These impacts are likely to be minor, given the availability of foraging habitat in the surrounding area.

The location of the Alternative C transmission line alignment on an east-facing ridge immediately north of the Sedlak Park Substation would reduce the risks of bald eagle wire strikes and electrocutions relative to Alternative B. Similar to Alternative B, recommendations outlined in Suggested Practices for Avian Protection on Power Lines (APLIC 2006) and Mitigating Bird

Collisions with Power Lines (APLIC 1994), as well as the Environmental Specifications (Appendix D) would be implemented.

Alternative D – Miller Creek Transmission Line Alternative

The impacts to bald eagles from Alternative D would be the same as Alternative C.

Alternative E – West Fisher Creek Transmission Line Alternative

Alternative E would have no direct physical impacts on bald eagle habitat in the nesting zone. About 30 acres of bald eagle foraging habitat and 107 acres of other potential habitat would be temporarily disturbed during construction of Alternative E (Table 175). As described in section 3.21, *Vegetation*, the clearing area for Alternative E would include about 6 acres of old growth habitat on private and state land where the transmission line crossed the Fisher River and paralleled West Fisher Creek. Alternative E would likely result in the clearing of large spruce and cottonwood trees in these old growth areas that provide potential bald eagle nest sites. Temporary disturbance impacts from Alternative E could also occur if increased noise and human presence associated with construction, including construction of the Sedlak Park Substation and loop line, caused eagles to avoid foraging in some areas. These impacts would likely be minor, given the availability of foraging habitat in the surrounding area. Also, disturbance impacts to bald eagles would be avoided through implementation of timing restrictions specified in the Environmental Specifications. The risks of bald eagle wire strikes and electrocutions would be the same as Alternatives C and D.

Cumulative Effects

Alternative A would not contribute to any cumulative effects on the bald eagle or its habitat. No other past, current, or reasonably foreseeable actions are anticipated to contribute to cumulative impacts on bald eagles, with the possible exception of private land development activities. Impacts to bald eagle from the transmission line alternatives would mostly be avoided through implementation of timing restrictions and other measures specified in APLIC (1994), APLIC (2006), and the Environmental Specifications (Appendix D).

3.24.4.2.4 Regulatory/Forest Plan Consistency

Eagle Act

The transmission line alternatives would likely result in minimal impacts to the bald eagle, and would be in compliance with the Eagle Act (16 U.S.C. 668-668C 1978).

KFP

The KNF is directed to "identify, protect, and manage" habitat for sensitive species in order to assist in maintaining viable populations. The KFP contains the following goals and direction for sensitive species: "determine the status of sensitive species and provide for their environmental needs as necessary to prevent them from becoming threatened or endangered" (KFP Vol. 1, II-1 #6). The MBEWG guidelines state that "structures that pose a hazard such as overhead utility lines should not be constructed within Zone II (Primary Use Area) of all nests." Alternative B would not be consistent with KFP guidelines because it would be constructed within the Primary Use Area for the Silverfish nest site. All other alternatives would meet KFP direction for the bald eagle.

National Forest Management Act Statement of Findings

KFP direction is to "maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,… in sufficient quality and quantity to maintain viable populations" (KFP Vol. 1, II-1 #7). The diversity requirement of NFMA is met for the bald eagle by all alternatives. Alternative B could impact individual bald eagles and their habitat, but would not likely contribute to a trend toward federal listing or loss of species viability. Transmission line Alternatives C, D, and E could impact potential bald eagle nesting and foraging habitat and would have minor impacts on individual bald eagles and their habitat, but would not likely contribute to a trend toward federal listing or loss of species viability.

3.24.4.3 Black-backed Woodpecker

3.24.4.3.1 Analysis Area and Methods

Black-backed woodpecker population ecology, biology, habitat description and relationships identified by research are described in Powell (2000), Cherry (1997), Hutto (1995), and O'Connor and Hillis (2001). That information is incorporated by reference. Black-backed woodpecker occurrence data come from recent District wildlife observation records and KNF historical data (NRIS FAUNA).

Effects of the alternatives on black-backed woodpecker were evaluated based on impacts to high-quality and general forest habitat, and changes in the number of breeding black-backed woodpecker pairs potentially supported in the analysis area (potential population level or PPL). Potential black-backed woodpecker habitat was estimated based on the KNF Cumulative Effects Model (CEM) vegetation data and the KNF CEM black-backed woodpecker habitat model (see KNF project record). The number of potential black-backed woodpecker breeding pair territories, referred to as the potential population index (PPI), was estimated based on documented home range sizes (Cherry 1997). The maximum home range size of 800 acres was applied to general forest habitat, while the minimum home range size of 175 acres was applied to high-quality habitat. The difference in territory size for the two habitat components is based on the assumption that higher quality habitat can support a breeding pair with fewer acres. High quality habitat is defined as areas where recent (less than 10 years old) mixed-lethal or stand-replacement fire have occurred or where an abundance of snags are available. Low quality habitat consists mainly of general forest habitat with small scattered patches of snags produced by insect and disease. Black-backed woodpeckers have been found to be almost entirely restricted to early post-fire forests (Hutto 1995).

The analysis area for project impacts and cumulative effects to individuals and their habitat in the KNF consists of the Crazy and Silverfish PSUs. To evaluate potential direct and indirect impacts of the transmission line on black-backed woodpeckers, the analysis area includes all non-National Forest System land within a corridor 1 mile on each side of the transmission line alternatives. The analysis area for cumulative effects is the KNF and any non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments.

The analysis area includes private and state lands crossed by the eastern portions of the transmission line alternatives. Specific black-backed woodpecker habitat information is not available for private or state-owned lands in the analysis area, much of which has been logged in the past 20 to 30 years. Black-backed woodpecker habitat on private and state land was estimated based on mapping of coniferous forest shown on Figure 83 and old growth forest shown on

Figure 84. Habitat quality on private and state land was evaluated based on past and current land use practices.

The impacts analysis includes an evaluation of the potential benefits to black-backed woodpecker from mitigation measures proposed by MMC or the agencies, such as black-backed woodpecker surveys and, if appropriate, the establishment of avoidance areas where tree removal would not occur.

3.24.4.3.2 Affected Environment

Habitat for black-backed woodpeckers consists of boreal and montane forest where wood-boring beetle (including *Monochamus* spp. and Englemann spruce beetle, *Dendroctonus englemanni*) outbreaks are occurring as a result of disturbances caused by fire, wind, and disease. Black-backed woodpecker habitat in the Crazy and Silverfish PSUs is mainly lower quality black-backed woodpecker habitat. This lower quality habitat supports low populations of resident black-backed woodpeckers. About 6,083 acres of general forest habitat occurs in the Crazy PSU, while 7,479 acres of general forest occurs in the Silverfish PSU. High quality habitat consists of 9,060 acres in the Crazy PSU and 7,958 acres in the Silverfish PSU. The estimated PPI for the Crazy and Silverfish PSUs is 59 pairs and 55 pairs, respectively.

As primary cavity-nesters, black-backed woodpeckers require dead or live trees with heartwood rot and show a preference for Douglas fir, ponderosa pine, lodgepole pine, and western larch. According to Thomas (1979, p. 74), a PPL of 40 percent or more should maintain viable populations of birds dependent on cavities for nest sites. The existing PPL for the Crazy and Silverfish PSUs is 69 and 73 percent, respectively.

On a forest-wide level, potential black-backed woodpecker habitat is abundant, broadly distributed, and amounts to 1,317,790 acres of general forest habitat. The nearest recorded observation of a black-backed woodpecker to the analysis area occurred in 1995 in a burned area west of Rock Creek (MNHP 2005). No recent burns were observed in the analysis area during field work conducted in 2005, although potential habitat for the black backed woodpecker occurs in old growth stands and in areas with western larch snags along the transmission line alignments (Westech 2005a). No black-backed woodpeckers were observed during black-backed woodpecker surveys of more than 1 mile of the Libby Creek wildfire burn area in 2003 and 2004 (see KNF project record). No black-backed woodpeckers were observed during breeding bird monitoring and point count surveys of old growth stands in and adjacent to the proposed impoundment sites and Libby Plant Site conducted in 1992 (Mitchell and Bratkovich 1993), 2002, and 2004 (see KNF project record). Similarly, no black-backed woodpeckers have been observed during Region One (USFS) landbird monitoring surveys of transects established directly northwest of the proposed LAD Area 1 and in Miller Creek along NFS road #4724 in 1994, 1995, 1996, 1998, 2000, 2002, and 2004 (ibid.). The majority of the non-National Forest System lands in the analysis area have high road densities, allowing access for firewood collection, and have been logged in the past 20 to 30 years (Figure 83), and it is not likely that snags have been left standing. As a result, snag and down wood important to black-backed woodpeckers is likely to be less available on private and state lands.

3.24.4.3.3 Environmental Consequences

Impacts to black-backed woodpecker from mine (Table 176) and transmission line alternatives (Table 177) are described in the following subsections. The mine alternatives would not affect black-backed woodpeckers in the Silverfish PSU and are not displayed in Table 176.

Alternative 1 – No Mine

Impacts to black-backed woodpecker habitat resulting from the mine alternatives are shown in Table 176. The No Mine Alternative would not have any direct impacts to black-backed woodpeckers or their habitat.

Alternative 2 – MMC's Proposed Mine

Alternative 2 would have no effect on black-backed woodpecker habitat in the Silverfish PSU. In the Crazy PSU, about 416 acres of general forest habitat and 473 acres of high-quality black-backed woodpecker habitat would be impacted by Alternative 2, reducing the PPI by 3 pairs to 56 nesting pairs (Table 176). Although individual black-backed woodpeckers may be affected, effects on the black-backed woodpecker population would be minimal, given the quantity of existing habitat. Despite several surveys conducted in the Crazy and Silverfish PSUs, no black-backed woodpecker nests were identified in the analysis area. Because potential black-backed woodpecker habitat occurs in the analysis area, Alternative 2 could result in the destruction of black-backed woodpecker nests or nest abandonment by black-backed woodpeckers. The Alternative 2 tailings impoundment would result in the loss of 715 acres of potential habitat in one localized area, which could displace one or more nesting black-backed woodpecker pairs that may have traditionally used the area.

Table 176. Impacts to Black-backed Woodpecker Habitat in the Crazy PSU and the KNF by Mine Alternative.

Habitat Type	[1] No Mine/Existing Conditions	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment	[4] Agency Mitigated Little Cherry Creek Impoundment
Crazy PSU				
General Forest Foraging Habitat (acres)	6,083	5,667 (-416/-7)	5,541 (-542/9)	5,760 (-323/-5)
High Quality Habitat (acres)	9,060	8,587 (-473/-6)	8,799 (-261/-3)	8,433 (-627/-7)
PPI[1]	59	56	57	55
KNF				
PPI	1,647	1,644	1,645	1,643

Number in parentheses is the decrease in habitat acres/percent change in habitat area compared to existing conditions.

[1] Based on a home range size of 800 acres for general forest habitat and 175 acres for high-quality habitat.

Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 177. Impacts to Black-backed Woodpecker Habitat in the Analysis Area by Transmission Line Alternative.

Habitat Type	[A] No Transmission Line/Existing Conditions	[B] MMC's Proposed Transmission Line (North Miller Creek Alternative)	[C] Modified North Miller Creek Transmission Line	[D] Miller Creek Transmission Line	[E] West Fisher Creek Transmission Line
Crazy PSU					
General Forest Foraging Habitat (acres)	6,083	6,062 (-21/<-1)	6,062 (-21/<-1)	6,058 (-25/<-1)	6,058 (-25/<-1)
High Quality Habitat (acres)	9,060	9,048 (-12/<-1)	9,051 (-9/<-1)	9,047 (-13/<-1)	9,047 (-13/<-1)
PPI[1]	59	59	59	59	59
Silverfish PSU					
General Forest Foraging Habitat (acres)	7,479	7,465 (-14/<-1)	7,465 (-14/<-1)	7,471(-8/<-1)	7,471 (-8/<-1)
High Quality Habitat (acres)	7,958	7,942 (-16/<-1)	7,941(-17/<-1)	7,926 (-32/<-1)	7,896 (-62/<-1)
PPI[1]	55	55	55	55	54
KNF					
PPI	1,647	1,647	1,647	1,647	1,647
State and Private Land					
Potential habitat affected (acres)	N/A	18	67	73	58

N/A = Not applicable.

Numbers in parentheses is the decrease in habitat acres/percent change in habitat area compared to existing conditions.

[1] Based on a home range size of 800 acres for general forest habitat and 175 acres for high-quality habitat.

Source: GIS analysis by ERO Resources Corp. using KNF data.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Impacts from Alternative 3 on black-backed woodpecker would be slightly less than Alternative 2. In the Crazy PSU, Alternative 3 would affect about 542 acres of general forest habitat and 261 acres of high-quality black-backed woodpecker habitat, reducing the PPI by 2 pairs to 57 nesting pairs (Table 176). The Alternative 3 tailings impoundment would result in the loss of 685 acres of potential habitat in one localized area, which could displace one or more nesting black-backed woodpecker pairs that may have traditionally used the area. Although no black-backed woodpecker nests were identified in the analysis area, surveys would be conducted in potential black-backed woodpecker habitat prior to project construction to identify potentially impacted nests. If an active nest were found in the project vicinity, tree removal would not occur in an avoidance area appropriate for the species until young have fledged. These measures would minimize potential impacts to nesting black-backed woodpeckers.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts from Alternative 4 on black-backed woodpecker would be slightly more than Alternative 2. In the Crazy PSU, Alternative 4 would affect about 323 acres of general forest habitat and 627 acres of high-quality black-backed woodpecker habitat, reducing the PPI by 4 pairs to 55 nesting pairs (Table 176). The Alternative 4 tailings impoundment would result in the loss of 503 acres of potential habitat in one localized area, which could displace one or more nesting black-backed woodpecker pairs that may have traditionally used the area. Clearing restrictions and pre-construction surveys described for Alternative 3 also would apply for Alternative 4.

Alternative A – No Transmission Line

Impacts to black-backed woodpecker habitat resulting from the transmission line alternatives are shown in Table 177. The No Transmission Line Alternative would not impact black-backed woodpecker habitat.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Both general forest and high-quality black-backed woodpecker habitat would be impacted by Alternative B in the Crazy and Silverfish PSUs, but impacts would be too small to change the PPI (Table 177). Alternative B would affect about 21 acres of general forest habitat and 12 acres of high-quality black-backed woodpecker habitat in the Crazy PSU, and about 14 acres of general forest habitat and 16 acres of high-quality black-backed woodpecker habitat in the Silverfish PSU. The Alternative B clearing area would include about 18 acres of coniferous forest providing potential black-backed woodpecker habitat. The quality of the black-backed woodpecker habitat on private land is unknown.

Several surveys conducted in the Crazy and Silverfish PSUs; no black-backed woodpecker nests were identified in the analysis area. As specified in the Environmental Specifications (Appendix D), either tree removal would not occur during black-backed woodpecker breeding season, or surveys would be conducted in potential black-backed woodpecker habitat prior to project construction to identify potentially impacted nests. If an active nest were found in the project vicinity, tree removal would not occur in an avoidance area appropriate for the species until young have fledged. These measures would minimize potential impacts to nesting black-backed woodpeckers.

Alternative C – Modified North Miller Creek Transmission Line Alternative

Impacts to black-backed woodpecker from Alternative C would be similar to Alternative B, affecting 3 fewer acres of high-quality habitat in the Crazy PSU, 1 acre more of high-quality habitat in the Silverfish PSU, and 49 more acres of potential habitat on private land. The quality of the black-backed woodpecker habitat on private land is unknown. Alternative C also would comply with the Environmental Specifications (Appendix D).

Alternative D – Miller Creek Transmission Line Alternative

Overall, Alternative D would have greater impacts on black-backed woodpecker habitat than Alternatives B and C, but impacts from Alternative D would be too small to change the PPI (Table 177). Alternative D would affect about 25 acres of general forest habitat and 13 acres of high-quality black-backed woodpecker habitat in the Crazy PSU, and about 8 acres of general forest habitat and 32 acres of high-quality black-backed woodpecker habitat in the Silverfish PSU. The Alternative D clearing area would include about 73 acres of coniferous forest providing potential black-backed woodpecker habitat. The quality of the black-backed woodpecker habitat on private land is unknown. Alternative D also would comply with the Environmental Specifications (Appendix D).

Alternative E – West Fisher Creek Transmission Line Alternative

Both general forest and high-quality black-backed woodpecker habitat would be impacted by Alternative E in the Crazy and Silverfish PSUs, Most of the impacts would occur to high-quality habitat in the Silverfish PSU, reducing the PPI by 1 nesting pair, or 2 percent (Table 177). Given the existing available habitat and PPI, impacts from Alternative E on black-backed woodpecker in the Crazy and Silverfish PSUs would be minor.

Combined Mine-Transmission Line Effects

Impacts to black-backed woodpecker habitat in the analysis area are shown in Table 178.

Impacts to black-backed woodpecker in the Crazy PSU would range from 344 to 567 acres of general forest foraging habitat and from 270 to 640 acres of high-quality habitat. Impacts in the Crazy PSU would be the greatest for Alternatives 4C, 4D, and 4E, resulting in a 4 percent reduction in PPI in the Crazy PSU. For all combined action alternatives, impacts to black-backed woodpecker in the Silverfish PSU would be due entirely to the transmission line. Impacts in the Silverfish PSU would range from 8 to 14 acres of general forest foraging habitat and 16 to 32 acres of high-quality habitat, and would not measurably affect the PPI. Overall, impacts in the Silverfish PSU would be greatest for Alternatives 3D, 3E, 4D, and 4E due to the length of the transmission line for these alternatives. Impacts to potential black-backed woodpecker habitat on state and private lands would range from 18 acres for Alternative B to 73 acres for Alternatives 3D and 4D. Despite several surveys conducted in the Crazy and Silverfish PSUs, no black-backed woodpecker nests were identified in the analysis area. Although the occupancy of the Crazy and Silverfish PSUs by nesting black-backed woodpeckers is not certain, the loss of potential habitat resulting from the combined action alternatives could reduce the quality of the habitat in these PSUs for nesting black-backed woodpeckers through increased habitat fragmentation, edge effects, and disturbance effects. For all alternatives, construction of the tailings impoundment would result in the loss of between 503 and 715 acres of potential habitat in one localized area, which could displace one or more nesting black-backed woodpecker pairs that may have traditionally used the area. In terms of PPI, the impacts of the combined action alternatives on black-backed woodpecker populations in the Crazy or Silverfish PSU would be minimal.

Table 178. Impacts to Black-backed Woodpecker Habitat in the Analysis Area by Combined Mine-Transmission Line Alternatives.

Measurement Criteria	[1] No Mine Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Alternative		
	TL-A	TL-B	TL-C	TL-D	TL-E	TL-C	TL-D	TL-E
Crazy PSU								
General Forest Foraging Habitat (acres)	6,083	5,646 (-437)	5,520 (-563)	5,516 (-567)	5,516 (-567)	5,739 (-344)	5,735 (-348)	5,735 (-348)
High Quality Habitat (acres)	9,060	8,575 (-485)	8,790 (-270)	8,786 (-274)	8,786 (-274)	8,424 (-636)	8,420 (-640)	8,420 (-640)
PPI[1]	59	56	57	57	57	55	55	55
Silverfish PSU								
General Forest Foraging Habitat (acres)	7,479	7,465 (-14)	7,465 (-14)	7,471 (-8)	7,471 (-8)	7,465 (-14)	7,471 (-8)	7,471 (-8)
High Quality Habitat (acres)	7,958	7,942 (-16)	7,941 (-17)	7,926 (-32)	7,896 (-32)	7,941 (-17)	7,926 (-32)	7,896 (-32)
PPI[1]	55	55	55	55	54	55	55	54
KNF								
PPI	1,647	1,644	1,645	1,645	1,645	1,643	1,643	1,643
Private Land								
Potential habitat affected (acres)	N/A	18	67	73	58	67	73	58

N/A = Not applicable.
Number in parentheses is the decrease in habitat acres compared to existing conditions.
[1]Based on a home range size of 800 acres for general forest habitat and 175 acres for high-quality habitat.
Source: GIS analysis by ERO Resources Corp. using KNF data.

In all combined action alternatives, as described in the Environmental Specifications (Appendix D), either tree removal would not occur during black-backed woodpecker breeding season, or surveys would be conducted in potential black-backed woodpecker habitat prior to project construction to identify potentially impacted nests. If an active nest were found in the project vicinity, tree removal would not occur in an avoidance area appropriate for the species until young have fledged. These measures would minimize potential impacts to nesting black-backed woodpeckers. Alternative 2B does not include timing restrictions or black-backed woodpecker surveys of the mine disturbance area.

Cumulative Effects

Past actions, particularly timber harvest, road construction, fire suppression, and firewood gathering activities, have contributed to a reduction in potential black-backed woodpecker habitat (USDA Forest Service 2003b). Firewood cutting and gathering would continue to occur where open roads provide access to forest habitat, contributing to the removal of snags and down wood important for black-backed woodpeckers. Continuing development of private lands, including timber harvest, home construction, and land clearing would contribute to losses of potential black-backed woodpecker habitat in the analysis area.

The Miller-West Fisher Vegetation Management Project would include regeneration harvest of about 475 acres, slash treatment of 681 acres, and prescribed burning of 3,751 acres of National Forest System lands in the Silverfish PSU. Timber harvest and other clearing activities planned for the Miller-West Fisher Vegetation Management Project in the Silverfish PSU would contribute to cumulative losses of snags and down wood important to black-backed woodpecker. Activities associated with the Miller-West Fisher Vegetation Management Project are expected to retain cavity habitat within KFP-recommended levels for the Silverfish PSU. Also, while prescribed burns associated with the Miller-West Fisher Vegetation Management Project would consume some snags and down wood, it also would create snags and down wood by killing live trees. Snags and down wood created in burned areas would provide both feeding and nesting habitat for the black-backed woodpecker. Other reasonably foreseeable actions would involve minimal disturbance to snags and down wood. The No Action alternatives (Alternative 1 and Alternative A) would not contribute to cumulative impacts to the black-backed woodpecker. In combination with other reasonably foreseeable actions, the combined mine-transmission line alternatives would likely have minor impacts on black-backed woodpeckers and would probably not affect black-backed woodpecker populations in either PSU or in the KNF.

3.24.4.3.4 Regulatory/Forest Plan Consistency

KFP

The KNF is directed to "identify, protect, and manage" habitat for sensitive species in order to assist in maintaining viable populations. The KFP contains the following goals and direction for sensitive species: "determine the status of sensitive species and provide for their environmental needs as necessary to prevent them from becoming threatened or endangered" (KFP Vol. 1, II-1 #6). All alternatives would meet this direction for the black-backed woodpecker.

All action alternatives would be consistent with KFP direction for snags and down wood (see section 3.24.2, *Key Habitats*). In all combined mine-transmission line alternatives, a wide range of successional habitats, and associated amounts of down wood would be available. The action alternatives would be consistent with KFP direction to maintain diverse age classes of vegetation for viable populations (KFP Vol. 1, II-1 #7).

National Forest Management Act

KFP direction is to "maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,... in sufficient quality and quantity to maintain viable populations" (KFP Vol. 1, II-1 #7). All combined action alternatives may impact individuals and/or their habitat, but would not contribute to a trend toward federal listing or loss of species viability for the black-backed woodpecker. This determination is based on: 1) the mine alternatives would have no impact on black-backed woodpeckers in the Silverfish PSU; 2) the combined action alternatives would result in habitat loss and the reduction of the black-backed woodpecker PPI in the Crazy PSU of 2 to 4 nesting pairs; 3) the combined action alternatives would result in habitat loss but would not change the PPI in the Silverfish PSU; and 4) no black-backed woodpeckers have been observed in the Crazy or Silverfish PSU, despite several recent surveys. While some individuals could be affected, given the availability of habitat, these impacts would not affect black-backed woodpecker populations in either the Crazy or Silverfish PSU or the KNF.

3.24.4.4 Coeur D'Alene Salamander

3.24.4.4.1 Analysis Area and Methods

Coeur d'Alene salamander population ecology, biology, habitat description, and relationships identified by research are described in Cassirer *et al.* (1994) and Maxell (2000). That information is incorporated by reference. Coeur d'Alene salamander occurrence data come from recent District wildlife observation records and KNF historical data (NRIS FAUNA), MNHP, and other agencies, such as FWP. Because the only area in the Crazy or Silverfish PSU potentially affected by the proposed project where the Coeur d'Alene salamander could potentially occur is adjacent to Bear Creek Road (NFS road #278), the analysis of potential impacts of the proposed project on individuals of this species or their habitat is limited to this area. The analysis area for cumulative effects is the Crazy PSU.

The impacts analysis includes an evaluation of the benefits to the Coeur d'Alene salamander from mitigation measures proposed by MMC or the agencies described in sections 2.4.6, Mitigation Plans and 2.5.7, Mitigation Plans or Appendix D, such as wetlands mitigation and implementation of BMPs, and riparian and water quality standards.

3.24.4.4.2 Affected Environment

The Coeur d'Alene salamander has been found below 5,000 feet in western Montana and is the only species of lungless salamander in the northern Rocky Mountain region (Cassirer *et al.* 1994). The salamander is associated with seepages, waterfalls, and small creeks near talus with fractured rock and with dense overstory canopies (Werner *et al.* 2004).

Johnson (1999) shows Coeur d'Alene salamander confirmed presence in four of the eight planning units on the KNF at 13 different sites. The salamander has been confirmed in two additional planning units since 1999 and the known sites now total 36. Known populations on the KNF are isolated by miles of unsuitable habitat that cannot be crossed (Maxell 2000; Maxell *et al.* 2003).

Historical records show that Coeur d' Alene salamanders were observed prior to 1990 adjacent to the Bear Creek Road (NFS road #278) on the northeast side of Big Hoodoo Mountain, and adjacent to the Libby Creek Road (NFS road #231) about 1.5 miles northeast of MMC's proposed Little Cherry Creek Impoundment. Despite recent surveys, no recent observations of the Coeur d'

Alene salamander in the Crazy and Silverfish PSUs have been recorded, and recent field work within these areas suggest the habitat has been degraded and is atypical of Coeur d' Alene salamander habitat (Westech 2005a).

3.24.4.4.3 Environmental Consequences

Impacts of the mine alternatives on the Coeur d' Alene salamander are described below. The transmission line alternatives would not affect the Coeur d' Alene salamander and are not included in the analysis.

Alternative 1 – No Mine

Alternative 1 would not disturb Coeur D'Alene salamanders or their habitat and would have no effect on this species.

Alternative 2 – MMC's Proposed Mine

According to Maxell (2000), the greatest threats to the Coeur d'Alene salamander are timber harvest, fire, road and trail development and maintenance, vehicle use on roads, and isolation of populations. Widening and improvement of the Bear Creek Road (NFS road #278) could impact small amounts of potential Coeur d'Alene salamander habitat. Some incidental mortality could occur due to forest clearing and increased traffic associated with Alternative 2. Impacts to the Coeur d'Alene salamander are not likely to occur because none have been recently observed in the analysis area and habitat in the analysis area does not appear to provide characteristics typically favored by this species. In addition, any adverse effects to wetlands or riparian habitat occurring in potential Coeur d'Alene salamander habitat would be minimized or avoided through implementation of BMPs and riparian and water quality standards, and compliance with the Clean Water Act. Any wetlands affected would be replaced with wetlands with similar functions and values.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Impacts to the Coeur d'Alene salamander from Alternative 3 would be the same as Alternative 2.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts to the Coeur d'Alene salamander from Alternative 4 would be the same as Alternative 2.

Cumulative Effects

Alternative 1 would not have cumulative impacts on the Coeur d'Alene salamander. The mine alternatives would not likely affect, and would not contribute to cumulative effects, to the Coeur d'Alene salamander. No other reasonably foreseeable actions would affect any known locations of Coeur d'Alene salamander; cumulative impacts to this species would be negligible.

3.24.4.4.4 Regulatory/Forest Plan Consistency

KFP

The KNF is directed to "identify, protect, and manage" habitat for sensitive species in order to assist in maintaining viable populations. The KFP contains the following goals and direction for sensitive species: "determine the status of sensitive species and provide for their environmental needs as necessary to prevent them from becoming threatened or endangered" (KFP Vol. 1, II-1 #6); all mine alternatives meet KFP direction.

National Forest Management Act

KFP direction is to "maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,… in sufficient quality and quantity to maintain viable populations" (KFP Vol. 1, II-1 #7). The combined mine-transmission line alternatives would not likely impact individuals and/or their habitat, and would not contribute to a trend toward federal listing or loss of species viability for the Coeur d'Alene salamander. This determination is based on 1) no Coeur d'Alene salamanders have been recently observed in the analysis area; 2) habitat in the analysis area does not appear to provide characteristics typically favored by this species; and 3) any adverse effects to wetlands or riparian habitat occurring in potential Coeur d'Alene salamander habitat would be minimized or avoided through implementation of BMPs and riparian and water quality standards, and compliance with the Clean Water Act. As described in sections 2.4.6.1, *Wetland Mitigation Plan* and 2.5.7.1, *Wetland Mitigation*, any wetlands affected would be replaced with wetlands with similar functions and values.

3.24.4.5 Fisher

3.24.4.5.1 Analysis Area and Methods

Fisher population ecology, biology, habitat description and relationships identified by research are described in Powell and Zielinski (1994) and Heinemeyer and Jones (1994). That information is incorporated by reference. Fisher occurrence data come from recent District wildlife observation records and KNF historical data (NRIS FAUNA) and other agencies, such as the FWP. Potential fisher habitat was estimated based on the KNF CEM and the TSMRS vegetation data (see KNF project record). The number of male or female fishers potentially supported by a given area, referred to as the potential population index (PPI), was estimated by dividing total habitat by average home range, based on an average male fisher home range of 10,000 acres, and an average female fisher home range of 3,700 acres (Powell and Zielinski 1994). The index includes both male and female fishers because their home ranges overlap extensively (ibid.). The analysis area for project impacts to individuals and their habitat in the KNF consists of the Crazy and Silverfish PSUs. To evaluate potential direct and indirect impacts of the transmission line on fishers, the analysis area includes all non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments. The analysis area for cumulative effects is the KNF and any non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments.

The analysis area includes private and state lands crossed by the eastern portions of the alternative transmission line alignments. Specific fisher habitat information is not available for private or state-owned lands in the analysis area, much of which has been logged in the past 20 to 30 years. Fisher habitat on private land was estimated based on mapping of coniferous forest shown on Figure 83 and old growth shown on Figure 84 and likely past and current land use practices.

The impacts analysis includes an evaluation of the benefits to fisher from mitigation measures proposed by MMC or the agencies described in sections 2.4.6, *Mitigation Plans* and 2.5.7, *Mitigation Plans* or Appendix D, such as wetlands mitigation and minimization of impacts to riparian habitat.

3.24.4.5.2 Affected Environment

In the western United States, fishers prefer late-successional forests (mature or old growth forests), and low elevation, moist riparian corridors for resting, denning, and travel (Heinemeyer

and Jones 1994). The fisher feeds on a variety of prey, from small to medium-sized mammals, birds, and carrion (Powell and Zelinski 1994). Fishers use an assortment of habitats for feeding, although they avoid non-forested areas (Jones and Garton, and Roy *In* Ruggiero *et al.* 1994).

In the western United States, fisher populations are limited to certain mountain ranges in the Pacific Northwest and Rocky Mountains. These isolated populations may be acutely susceptible to local extinction (Heinemeyer and Jones 1994). Fishers once occurred in the Cabinet Mountains, but were eliminated locally by overtrapping and habitat alteration (Ruggiero *et al.* 1994; Vinkey *et al.* 2006). Between 1989 and 1991, 110 fishers from the Midwest were released in the Cabinet Mountains as part of a state translocation program. Vinkey (2003) studied the distribution of fishers in the Cabinet Mountains using winter snow tracking, track plates, and live-trapping surveys conducted from 2001 to 2003. All verified records of fishers from this study were from the west Cabinet Mountains. Vinkey (2003) concluded that the introduction of fishers to the Cabinet Mountains has established a small population, but that the long-term viability of this population is uncertain. The KNF provides suitable fisher habitat, but both current and historical information suggests that fisher have never been abundant in the Cabinet Mountains (Heinz 1996; Vinkey 2003). The current population of fishers in the Cabinet Mountains is unknown. Fishers are generally more common where human density is low and human disturbance is reduced (Ruggiero *et al.* 1994).

Johnson (1999) shows fisher presence confirmed in five of the eight planning units on the KNF. Fisher observation and monitoring data indicates that suitable habitat is present within the analysis area, especially along forested streams. There have been no recent (since 2000) sightings of fishers within the analysis area, but historical observations have been recorded within the Crazy and Silverfish PSUs. A fisher den was found in 1989 near Horse Mountain (Roy 1991). Fishers are known to be present within the Libby Creek drainage, and are possibly present within the Poorman Creek, Ramsey Creek, and West Fisher Creek drainages (Westech 2005a).

Ruediger (1994) shows the KNF as a primary habitat area for fisher. Based on habitat modeling, 9,077 and 8,172 acres of potential fisher habitat occur in the Crazy and Silverfish PSUs, respectively. The Crazy PSU is within the Kootenai planning unit, and the Silverfish PSU is within the Fisher planning unit. Following the identification process outlined in Ruediger (1994), these planning units are designated as secondary fisher conservation areas (Johnson 2004b). The Crazy and Silverfish PSUs are considered high-quality fisher habitat areas (Id.).

Based on the average male and female fisher home range sizes, the PPI for each of the Crazy and Silverfish PSUs is 2 female and 1 male fisher. Based on potential yearlong habitat (Johnson 1999), the minimum PPI for the KNF would be 29 male and 80 female fishers.

Old growth habitat on private and state land in the analysis area consists mostly of cottonwood/ spruce riparian habitat. The majority of the non-National Forest System lands in the analysis area have high road densities and have been logged in the past 20 to 30 years (Figure 83), resulting in fragmented forest habitat. Potential fisher habitat on private and state lands is likely of marginal quality.

3.24.4.5.3 Environmental Consequences

Impacts to fisher from mine and transmission line alternatives are shown in Table 179 and Table 180 and are described in the following subsections. Impacts from the mine alternatives would not affect fishers in the Silverfish PSU and are not displayed in Table 179.

Table 179. Fisher Habitat in the Crazy PSU and the KNF by Mine Alternative.

Measurement Criteria	[1] No Mine/Existing Conditions	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment	[4] Agency Mitigated Little Cherry Creek Impoundment
Crazy PSU				
Fisher Habitat (acres)	9,077	8,737 (-340/-4)	8,822 (-255/-3)	8,846 (-231/-3)
PPI (Males) [1]	1	1	1	1
PPI (Females) [1]	2	2	2	2
KNF				
Fisher Habitat (acres)	294,531	294,191 (-340/<-1)	294,276 (-255/<-1)	294,300 (-231/<-1)
PPI (Males) [1]	29	29	29	29
PPI (Females) [1]	80	80	80	80

Number in parentheses is the decrease in habitat acres/percent change in habitat area compared to existing conditions.

[1] Based on an average male fisher home range of 10,000 acres and an average female fisher home range of 3,700 acres.

Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 180. Effects on Fisher Habitat in the Analysis Area by Transmission Line Alternative.

Measurement Criteria	[A] No Transmission Line/ Existing Conditions	[B] MMC's Proposed Transmission Line (North Miller Creek Alternative)	[C] Modified North Miller Creek Transmission Line Alternative	[D] Miller Creek Transmission Line Alternative	[E] West Fisher Creek Transmission Line Alternative
Crazy PSU					
Fisher Habitat (acres)	9,077	9,049 (-28/<-1)	9,065 (-12/<-1)	9,060 (-17/<-1)	9,060 (-17/<-1)
PPI (Males) [1]	1	1	1	1	1
PPI (Females) [1]	2	2	2	2	2
Silverfish PSU					
Fisher Habitat (acres)	8,172	8,172 (0)	8,172 (0)	8,164 (8/<-1)	8,159 (13/<-1)
PPI (Males) [1]	1	1	1	1	1
PPI (Females) [1]	2	2	2	2	2
KNF					
Fisher Habitat (acres)	294,531	294,503 (-28/<-1)	294,519 (-12/<-1)	294,506 (-25/<-1)	294,501 (-30/<-1)
PPI (Males) [1]	29	29	29	29	29
PPI (Females) [1]	80	80	80	80	80
Private and State Land					
Coniferous forest affected (acres)	0	18	67	73	58
Old growth affected (acres)	0	4	2	2	6

Number in parentheses is the decrease in habitat acres/percent change in habitat area compared to existing conditions.
[1] Based on an average male fisher home range of 10,000 acres and an average female fisher home range of 3,700 acres.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Alternative 1 – No Mine

Alternative 1 would not impact the fisher or its habitat (Table 179).

Alternative 2 – MMC's Proposed Mine

No impacts to fisher would occur as a result of Alternative 2 in the Silverfish PSU. Alternative 2 would reduce the amount of fisher habitat in the Crazy PSU by 340 acres, mostly in the Little Cherry Creek Tailings Impoundment Site, but these impacts would be too small to change the existing PPI (Table 179). The risk of fisher mortality would increase as a result of increased traffic and increased winter access to fisher habitat from Alternative 2. Alternative 2 would include snowplowing Bear Creek Road (NFS road #278) and Libby Creek Road (NFS road #231) during the evaluation program, and while the Bear Creek Road is reconstructed, allowing trappers easy winter access to old growth and riparian areas providing good fisher habitat. Increased traffic could result in more fishers being killed by vehicles, although traffic increases are anticipated to be minimal (see section 3.20, *Transportation*). While research does not show fisher to be highly

sensitive to human activity, disturbance effects could occur due to the presence of people and machines during construction and operations, potentially displacing fishers from nearby suitable habitat. Displacement effects would probably be the greatest during the construction phase, but would continue at lower levels during operations. According to Heinemeyer and Jones (1994), the most sensitive time for fishers is the breeding, denning, and rearing period (February 15 to June 30). Impacts within 200 meters of perennial streams are especially important to avoid (ibid.). Impacts of Alternative 2 on riparian fisher habitat would be minimized through implementation of MMC's proposed Wetland Mitigation Plan (section 2.4.6.1, *Wetland Mitigation Plan*) and the Environmental Specifications (Appendix D).

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Impacts to fisher from Alternative 3 would be the same as Alternative 2, except that less fisher habitat would be affected (255 acres) (Table 179). Impacts of Alternative 3 on riparian fisher habitat would be minimized through implementation of the agencies' proposed Wetland Mitigation Plan (section 2.5.7.1, *Wetland Mitigation*) and the Environmental Specifications (Appendix D).

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts to fisher from Alternative 4 would be the same as Alternative 2, except that less fisher habitat would be affected (231 acres) (Table 179).

Alternative A – No Transmission Line

Table 180 summarizes the changes in habitat and PPI due to each alternative. Alternative A would not impact fisher habitat or PPI.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

No impacts to fisher would occur as a result of Alternative B in the Silverfish PSU. Alternative B would reduce the amount of fisher habitat in the Crazy PSU by 28 acres, but these impacts would be too small to change the existing PPI (Table 180). The risk of fisher mortality could increase as a result of increased traffic from Alternative B, although traffic increases are anticipated to be minimal (see section 3.20, *Transportation*). While research does not show fisher to be highly sensitive to human activity, disturbance effects could occur due to the presence of people and machines during transmission line construction, potentially displacing fishers from nearby suitable habitat. According to Heinemeyer and Jones (1994), the most sensitive time for fishers is the breeding, denning, and rearing period (February 15-June 30). Displacement effects would be negligible during operations because activities would be limited to line maintenance. Impacts of Alternative B on riparian fisher habitat would be reduced through implementation of MMC's proposed Wetland Mitigation Plan (section 2.4.6.1, *Wetland Mitigation Plan*), and the Environmental Specifications (Appendix D).

Alternative B would affect about 18 acres of coniferous forest and 4 acres of old growth providing fisher habitat on private land. Because fisher habitat on private land is likely of marginal quality, impacts to fisher would be minimal.

Alternative C – Modified North Miller Creek Transmission Line Alternative

Impacts to fisher from Alternative C on National Forest System land would be similar to Alternative B, except that less fisher habitat (12 acres) would be impacted. Impacts of Alternative

C on riparian fisher habitat would be minimized through implementation of the agencies' Wetland Mitigation Plan (section 2.5.7.1, *Wetland Mitigation*), the Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*), and the Environmental Specifications (Appendix D).

Alternative C would affect about 67 acres of coniferous forest and 2 acres of old growth forest providing potential fisher habitat on private land. Because habitat on private land is likely of marginal quality, impacts to fisher would be minimal.

Alternative D – Miller Creek Transmission Line Alternative

Impacts to fisher from Alternative D on National Forest System land would be similar to Alternative C, except that more fisher habitat (25 acres) would be impacted.

Alternative D would affect about 73 acres of coniferous forest and 2 acres of old growth providing habitat fisher on private land. Because fisher habitat on private land is likely of marginal quality, impacts to fisher would be minimal.

Alternative E – West Fisher Creek Transmission Line Alternative

Impacts to fisher from Alternative E on National Forest System land would be similar to Alternative C except that more fisher habitat (30 acres) would be impacted.

Alternative E would affect about 58 acres of coniferous forest and 6 acres of old growth providing fisher habitat fisher on private and state land. Because fisher habitat on private land is likely of marginal quality, impacts to fisher would be minimal.

Combined Mine-Transmission Line Effects

Alternative 2B would have the greatest impacts to fisher habitat in the Crazy PSU (impacting 368 acres) followed by Alternatives 3D and 3E (impacting 272 acres) (Table 181). Alternative 4C would affect the fewest acres of fisher habitat (243 acres) in the Crazy PSU. Alternatives 2B, 3C, and 3D would not impact fisher habitat in the Silverfish PSU. Impacts to fisher habitat in the Silverfish PSU for the other combined mine transmission line alternatives would range from 8 to 13 acres. None of the combined mine-transmission line alternatives would result in measurable changes to the fisher PPI in the Crazy or Silverfish PSU or the KNF.

In all combined action alternatives, the risk of fisher mortality would increase as a result of increased traffic and increased access to fisher habitat, although traffic increases are anticipated to be minimal (see section 3.20, *Transportation*). All combined action alternatives would include snowplowing Bear Creek Road (NFS road #278) and Libby Creek Road (NFS road #231) during the evaluation program and while the Bear Creek Road is reconstructed, providing trappers easy winter access to fisher habitat in old growth and riparian areas. While research does not show fishers to be highly sensitive to human activity, disturbance effects could occur due to the presence of people and machines during transmission line construction, potentially displacing fishers from nearby suitable habitat. According to Heinemeyer and Jones (1994), the most sensitive time for fisher is the breeding, denning, and rearing period (February 15 to June 30). In all combined action alternatives, impacts on riparian fisher habitat would be reduced through implementation of implementation of MMC's proposed Wetland Mitigation Plan (see Chapter 2), the agencies' Wetland Mitigation Plan and Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*), and the Environmental Specifications (Appendix D).

Table 181. Fisher Habitat in the Analysis Area by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] No Mine Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Alternative		
		TL-B	TL-C	TL-D	TL-E	TL-C	TL-D	TL-E
Crazy PSU								
Fisher Habitat (acres)	9,077	8,709 (-368)	8,810 (-267)	8,805 (-272)	8,805 (-272)	8,843 (-243)	8,829 (-248)	8,829 (-248)
PPI (Males) [1]	1	1	1	1	1	1	1	1
PPI (Females) [1]	2	2	2	2	2	2	2	2
Silverfish PSU								
Fisher Habitat (acres)	8,172	8,172 (0)	8,172 (0)	8,164 (-8)	8,159 (-13)	8,172 (0)	8,164 (-8)	8,159 (-13)
PPI (Males) [1]	1	1	1	1	1	1	1	1
PPI (Females) [1]	2	2	2	2	2	2	2	2
KNF								
Fisher Habitat (acres)	294,531	294,163 (-368)	294,264 (-267)	294,251 (-280)	294,246 (-285)	294,288 (-243)	294,275 (-256)	294,270 (-261)
PPI (Males) [1]	29	29	29	29	29	29	29	29
PPI (Females) [1]	80	80	80	80	80	80	80	80
Private and State Land								
Coniferous forest affected (acres)	0	18	67	73	58	67	73	58
Old growth affected (acres)	0	4	2	2	6	2	2	6

Number in parentheses is the decrease in habitat acres compared to existing conditions.
[1] Based on an average male fisher home range of 10,000 acres and an average female fisher home range of 3,700 acres.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Impacts to coniferous forest on state and private land would range from 18 acres for Alternative 2B to 73 acres for Alternatives 3D and 4D. Impacts to old growth on private land would range from 2 acres for Alternatives 3C, 3D, 4C, and 4D to 6 acres for Alternatives 3E and 4E. Because fisher habitat on private land is likely of marginal quality, impacts to fisher would be minimal.

Cumulative Effects

Past actions, particularly timber harvest, road construction, and fire-suppression activities have altered the old growth ecosystems in the analysis area, resulting in a reduction in early and late succession habitats; conditions favoring shade-tolerant, fire-intolerant species; loss of large snags and down wood; increases in tree density, and a shift to a largely mid-seral structural stage (USDA Forest Service 2003b). Continuing development of private lands, including timber harvest, home construction, and land clearing would contribute to losses of fisher habitat in the analysis area. Impacts to fisher on private and state lands would probably be minimal because it is likely that fisher habitat in these areas is of marginal quality.

Alternative 1A would not have cumulative impacts on the fisher. Regeneration harvest, prescribed burns, and other forest treatments proposed for the Miller-West Fisher Vegetation Management Project, which would occur in the Silverfish PSU, could contribute to cumulative losses and fragmentation of fisher habitat. The Miller-West Fisher Vegetation Management Project would not directly impact old growth that could provide potential fisher habitat. Surface impacts from other reasonably foreseeable actions in the analysis area would be minimal. While combined action alternatives, in combination with other past, current, and reasonably foreseeable actions, would result in some losses and degradation of fisher habitat, cumulative impacts on overall amounts of fisher habitat would not likely result in a measurable change in fisher PPI. In addition, mitigation associated with combined agencies' alternatives would increase the proportion of designated old growth and promote the maintenance or development of fisher habitat in the analysis area.

Other cumulative effects from the action alternatives and other reasonably foreseeable actions include an increased risk of fisher mortality due to increased trapping. For the combined action alternatives, traffic volumes and speeds may cumulatively be greater in the Miller Creek and West Fisher Creek drainages and near main access roads (see section 3.20, *Transportation*), resulting in an increased risk of fisher mortality from vehicle collisions. For the transmission line alternatives, cumulative traffic increases would occur primarily during the construction period and would be short-term. Cumulative traffic increases for the mine alternatives would be long-term and would last through the reclamation phase. Vehicle collisions with fishers could be prevented or reduced by installing wildlife crossing signs or reducing speed limits on roads used for the Montanore Project.

Cumulative impacts could be offset by habitat acquisitions and road access changes associated with grizzly bear mitigation for the Montanore Project and other reasonably foreseeable actions.

3.24.4.5.4 Regulatory/Forest Plan Consistency

KFP

The KNF is directed to "identify, protect, and manage" habitat for sensitive species in order to assist in maintaining viable populations. The KFP contains the following goals and direction for sensitive species: "determine the status of sensitive species and provide for their environmental

needs as necessary to prevent them from becoming threatened or endangered" (KFP Vol. 1, II-1 #6). All alternatives would meet this direction for the fisher.

All action alternatives would require a project-specific amendment to allow harvest within designated old growth stands (MA 13). MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*. The project-specific amendment would change the current MA 13 (Old Growth) allocation of all harvested stands to either MA 23 (Electric Transmission Corridor) or MA 31 (Mineral Development). All action alternatives would be consistent with KFP direction to maintain a minimum of 10 percent old growth below 5,500 feet in elevation in each third order drainage or compartment, or a combination of compartments.

National Forest Management Act

KFP direction is to "maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,... in sufficient quality and quantity to maintain viable populations" (KFP Vol. 1, II-1 #7). All combined action alternatives could impact individual fishers and/or their habitat, but would not contribute to a trend toward federal listing or loss of species viability for the fisher. This determination is based on: 1) the mine alternatives would have no impact on fishers in the Silverfish PSU; 2) all combined action alternatives would result in the direct loss of fisher habitat, but these impacts represent less than 1 percent of potential fisher habitat; 3) none of the combined action alternatives would result in measurable changes to the fisher PPI in the Crazy or Silverfish PSU or the KNF; 4) all action alternatives could result in an increase in the risk of fisher mortality due to increased traffic and winter access to fisher habitat; 5) all action alternatives would result in increased habitat fragmentation and disruption of movement in riparian corridors, and potential displacement from suitable habitat due to human disturbance; and 6) all combined mine-transmission line alternatives would be consistent with KFP direction to maintain a minimum of 10 percent old growth (fisher habitat) below 5,500 feet in elevation. While some individuals could be affected, impacts would not be severe enough to limit fisher recovery. Given the availability of habitat, these impacts would not affect fisher populations in either the Crazy or Silverfish PSU or the KNF.

3.24.4.6 Flammulated Owl

3.24.4.6.1 Analysis Area and Methods

Flammulated owl population ecology, biology, habitat description, and relationships identified by research are summarized in Hayward and Verner (1994). More recent research on nesting, food habits, home range and territories, and habitat quality conducted in Colorado, Idaho, and Montana is discussed in Linkhart (2001), Linkhart and Reynolds (1997), Linkhart *et al.* (1998), Powers *et al.* (1996), Wright (1996), and Wright *et al.* (1997). That information is incorporated by reference. Flammulated owl occurrence data come from recent District wildlife observation records and KNF historical data (NRIS FAUNA). Potential flammulated owl habitat was estimated based on the KNF Cumulative Effects Model (CEM) and TSMRS vegetation data, and the KNF CEM flammulated owl habitat model (see KNF project record).

The number of potential flammulated owl breeding pair territories, referred to as the potential population index (PPI), was estimated based on dividing the amount of habitat by an average home range size of 40 acres (Hayward and Verner 1994). Effects of the alternatives were evaluated based on changes in habitat and PPI.

The analysis area for project impacts and cumulative effects to individuals and their habitat consists of the Crazy and Silverfish PSUs. The analysis area includes private and state lands crossed by the eastern portions of the alternatives transmission line alignments. Specific flammulated owl habitat information is not available for private or state-owned lands in the analysis area, much of which has been logged in the past 20 to 30 years. Flammulated owl habitat on private land was estimated based on mapping of coniferous forest shown on Figure 83 and likely past and current land use practices.

The impacts analysis includes an evaluation of the potential benefits to flammulated owls from mitigation measures proposed by MMC or the agencies described in sections 2.4.6 and 2.5.7, *Mitigation Plans* and Appendix D, such as implementation of the Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*), flammulated owl surveys and, if appropriate, the establishment of avoidance areas where tree removal would not occur.

3.24.4.6.2 Affected Environment

Flammulated owl habitat consists of mature and old-growth xeric ponderosa pine and Douglas fir stands with low to moderate canopy closure (MNHP 2008). Flammulated owls typically nest in cavities excavated by other cavity-nesting birds (ibid.). The KNF provides about 237,098 acres of potential flammulated owl habitat and potential flammulated owl habitat occurs across all eight planning subunits (Johnson 1999). Field surveys have confirmed flammulated owl presence in six of eight planning units. The owl population size on the KNF is unknown (ibid.). Flammulated owl surveys using taped owl calls to draw a response from nesting birds have been conducted intermittently within the Crazy and Silverfish PSUs over the last decade. According to District flammulated owl observation and monitoring data, the species has been observed on numerous occasions in the past 13 years in the North Fork Miller Creek and the Miller Creek drainages. No observations of flammulated owls have been recorded within the Crazy PSU. No flammulated owls were found during surveys conducted in 2005 (Westech 2005a) in the Crazy and Silverfish PSUs.

Based on the potential nesting habitat acres from Johnson (1999), the minimum PPI for the KNF is 5,927 flammulated owl pairs. Based on habitat modeling, about 11,902 acres of potential flammulated owl habitat occur in the Crazy PSU, and 10,786 acres in the Silverfish PSU. Based on the average flammulated owl pair territory size, the PPI for the National Forest System lands within the Crazy and Silverfish PSUs is 298 and 270 flammulated owl pairs, respectively. These estimates of PPI are considered high based on actual survey results.

The majority of the non-National Forest System lands in the analysis area have high road densities and have been logged in the past 20 to 30 years (Figure 83), resulting in loss of snags and fragmented forest habitat. Coniferous forest on private lands is primarily dominated by dry ponderosa pine/Douglas-fir communities.

3.24.4.6.3 Environmental Consequences

Impacts to flammulated owls from mine and transmission line alternatives are shown in Table 182 and Table 183, and are described in the following subsections. Impacts from the mine alternatives would not affect flammulated owls in the Silverfish PSU and are not displayed in Table 182.

Alternative 1 – No Mine

Impacts to potential flammulated owl habitat caused by the mine alternatives are shown in Table 182. Alternative 1 would not impact flammulated owls or their habitat.

Alternative 2 – MMC's Proposed Mine

Alternative 2 would reduce the amount of flammulated owl habitat in the Crazy PSU by 343 acres, or 3 percent, and would change the PPI to 289 pairs (Table 182).

Table 182. Flammulated Owl Habitat in the Crazy PSU and the KNF by Mine Alternative.

Measurement Criteria	[1] No Mine/Existing Conditions	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment	[4] Agency Mitigated Little Cherry Creek Impoundment
Crazy PSU				
Flammulated Owl Habitat (acres)	11,902	11,559 (-343/-3)	11,714 (-188/-2)	11,690 (-212/-2)
PPI[1] (pairs)	298	289	293	292
KNF				
Flammulated Owl Habitat (acres)	237,098	236,755 (-343/<-1)	236,910 (-188/<-1)	236,886 (-212/<-1)
PPI[1] (pairs)	5,927	5,919	5,923	5,922

Number in parentheses is the decrease in habitat acres/percent change in habitat area compared to existing conditions.

[1] Based on an average flammulated owl home range size of 40 acres, rounded to nearest whole number. Due to rounding, KNF PPI may not be the result of direct subtraction of PPI impacts displayed.

Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 183. Effects on Flammulated Owl Habitat in the Analysis Area by Transmission Line Alternative.

Measurement Criteria	[A] No Transmission Line/Existing Conditions	[B] MMC's Proposed Transmission Line (North Miller Creek)	[C] Modified North Miller Creek Transmission Line	[D] Miller Creek Transmission Line	[E] West Fisher Creek Transmission Line
Crazy PSU					
Flammulated Owl Habitat (acres)	11,902	11,878 (-24/<-1)	11,894 (-8/<-1)	11,889 (-13/<-1)	11,889 (-13/<-1)
PPI[1] (pairs)	298	297	297	297	297
Silverfish PSU					
Flammulated Owl Habitat (acres)	10,786	10,778 (-8/<-1)	10,768 (-18/<-1)	10,786 (0/0)	10,706 (-80/<-1)
PPI[1] (pairs)	270	269	269	270	268
KNF					
Flammulated Owl Habitat (acres)	237,098	237,066 (-32/<-1)	237,072 (-26/<-1)	237,085 (-13/<-1)	237,005 (-93/<-1)
PPI[1] (pairs)	5,927	5,927	5,927	5,927	5,925
Private and State Land					
Coniferous forest affected (acres)	0	18	67	73	58

Number in parentheses is the decrease in habitat acres/percent change in habitat area compared to existing conditions.
[1] Based on an average flammulated owl home range size of 40 acres, rounded to nearest whole number. Due to rounding, KNF PPI may not be the result of direct subtraction of PPI impacts displayed.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Alternative 2 would include tree clearing within disturbance boundaries. Removal of large ponderosa pine or Douglas-fir trees and snags that provide potential nesting, feeding, singing, or roost sites could impact flammulated owls (Wright 1996). Given the existing snag levels (see section 3.24.2, *Key Habitats*), the loss of snags providing potential flammulated owl nesting habitat would have minor impacts on this species. If reclamation were successful, areas of disturbed flammulated owl habitat could potentially be restored to suitable habitat for this species in the long term.

Noise and other human-caused disturbances, such as blasting, construction of the plant and adit sites, road construction and use, and plant and adit operations could cause flammulated owls to avoid nearby habitat, at least temporarily. Disturbance impacts would likely be greatest during the construction phase, but could persist through mine operations.

Although no active flammulated owl nests were identified in the analysis area during surveys conducted in 2005 (Westech 2005a), because potential flammulated owl habitat occurs in the analysis area, Alternative 2 could result in the destruction of nests or nest abandonment by flammulated owls.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would affect less flammulated owl habitat than Alternatives 2 and 4. Alternative 3 would reduce the amount of flammulated owl habitat in the Crazy PSU by 188 acres, or 3 percent, and would change the PPI to 293 pairs (Table 182).

Alternative 3 would include tree clearing within disturbance boundaries. Removal of large ponderosa pine or Douglas-fir trees and snags that provide potential nesting, feeding, singing, or roost sites could impact flammulated owls (Wright 1996). Given the existing snag levels (see section 3.24.2, *Key Habitats*), the loss of snags providing potential flammulated owl nesting habitat would have minor impacts on this species. Implementation of the Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*) would minimize impacts to snags providing potential nesting and foraging habitat for flammulated owls. If reclamation were successful, areas of disturbed flammulated owl habitat could potentially be restored to suitable habitat for this species in the long term.

Although no active flammulated owl nests were identified in the analysis area during surveys conducted in 2005 (Westech 2005a), as specified in section 2.5.7.3, *Wildlife Mitigation*, surveys would be conducted in potential flammulated owl habitat prior to project construction to identify potentially impacted nests. If an active nest were found in the project vicinity, tree removal would not occur in an avoidance area appropriate for the species until young have fledged. These measures would minimize potential impacts to nesting flammulated owls.

Disturbance impacts to flammulated owls would be the same for Alternative 3 as Alternative 2.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts to flammulated owl from Alternative 4 would be the same as Alternative 3, except that less habitat would be affected (212 acres, or a 2 percent decrease) (Table 182). The PPI would be reduced by 6 flammulated owl pairs as a result of Alternative 4 impacts.

Alternative A – No Transmission Line

Impacts to potential flammulated owl habitat caused by the transmission line alternatives are shown in Table 183. Alternative A would not impact flammulated owl habitat.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Alternative B would reduce the amount of flammulated owl habitat in the Crazy and Silverfish PSUs by 24 and 8 acres, respectively. These impacts would represent less than 1 percent of the flammulated owl habitat in each PSU, and would change the PPI in each PSU by one flammulated owl pair (Table 183).

Alternative B would include tree clearing within disturbance boundaries. Removal of large ponderosa pine or Douglas-fir trees and snags that provide potential nesting, feeding, singing, or roost sites could impact flammulated owls (Wright 1996). Given the existing snag levels (see section 3.24.2, *Key Habitats*), the loss of snags providing potential flammulated owl nesting habitat would have minor impacts on this owl. If reclamation were successful and successional processes were allowed to take place, areas of disturbed flammulated owl habitat could potentially be restored to suitable habitat for this species in the long term.

Although no active flammulated owl nests were identified in the analysis area during surveys conducted in 2005 (Westech 2005a), as specified in the Environmental Specifications (Appendix D), surveys would be conducted in potential flammulated owl habitat prior to project construction to identify potentially impacted nests. If an active nest were found in the project vicinity, tree removal would not occur in an avoidance area appropriate for the species until young have fledged. These measures would minimize potential impacts to nesting flammulated owls.

Alternative B would affect about 18 acres of coniferous forest providing potential flammulated owl habitat on private land. Because flammulated owl habitat on private land is highly fragmented, impacts of Alternative B would be minimal.

Noise from helicopters during line stringing and from other construction-related activities could cause flammulated owls to avoid nearby habitat, at least temporarily. Disturbance impacts would be short-term and, with the exception of line maintenance activities, would cease after transmission line construction until decommissioning.

Alternative C – Modified North Miller Creek Transmission Line Alternative

Alternative C would reduce the amount of flammulated owl habitat in the Crazy and Silverfish PSUs by 8 and 18 acres, respectively. These impacts would represent less than 1 percent of the flammulated owl habitat in each PSU, and would change the PPI in each PSU by one flammulated owl pair (Table 183).

Alternative C would include tree clearing within disturbance boundaries. Removal of large ponderosa pine or Douglas-fir trees and snags that provide potential nesting, feeding, singing, or roost sites could impact flammulated owls (Wright 1996). Given the existing snag levels (see section 3.24.2, *Key Habitats*), the loss of snags providing potential flammulated owl nesting habitat would have minor impacts on this owl. Implementation of the Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*) would minimize impacts to snags providing potential nesting and foraging habitat for flammulated owls. If reclamation were successful and successional processes were allowed to take place, areas of disturbed flammulated owl habitat could potentially be restored to suitable habitat for this species in the long term.

Although no active flammulated owl nests were identified in the analysis area during surveys conducted in 2005 (Westech 2005a), as specified in the Environmental Specifications (Appendix D), surveys would be conducted in potential flammulated owl habitat prior to project construction to identify potentially impacted nests. If an active nest were found in the project vicinity, tree removal would not occur in an avoidance area appropriate for the species until young have fledged. These measures would minimize potential impacts to nesting flammulated owls.

Alternative C would affect about 67 acres of coniferous forest providing potential flammulated owl habitat on private land. Because flammulated owl habitat on private land is highly fragmented, impacts of Alternative C would be minimal. Disturbance impacts to flammulated owls would be the same for Alternative C as Alternative B.

Alternative D – Miller Creek Transmission Line Alternative

There would be no direct impacts from Alternative D to flammulated owl habitat in the Silverfish PSU. Alternative D impacts to flammulated owl in the Crazy PSU would be the same as

Alternative C, except that slightly more flammulated owl habitat (13 acres) would be impacted by Alternative D.

Alternative D would affect about 73 acres of coniferous forest providing potential flammulated owl habitat on private land. Because flammulated owl habitat on private land is highly fragmented, impacts of Alternative D would be minimal. Disturbance impacts to flammulated owls would be the same for Alternative D as Alternative B.

Alternative E – West Fisher Creek Transmission Line Alternative

Alternative E impacts to flammulated owl would be the same as Alternative D in the Crazy PSU. Due to the length of the transmission line, Alternative E would have the greatest impacts to flammulated owl habitat (80 acres) in the Silverfish PSU (Table 183). PPI in the Silverfish PSU would be reduced by two flammulated owl pairs. Disturbance impacts to flammulated owls would be the same for Alternative E as Alternative B.

Combined Mine-Transmission Line Effects

Impacts to flammulated owls from the combined mine-transmission line alternatives are shown in Table 184 and described below. Alternative 2B would have the greatest impacts to flammulated owl habitat in the Crazy PSU, impacting 367 acres, followed by Alternatives 3D and 3E, which would affect 225 acres. Alternative 4C would affect the fewest acres of flammulated owl habitat (196 acres) in the Crazy PSU. Alternatives 2B, 3D, and 4D would not impact flammulated owl habitat in the Silverfish PSU. Impacts to flammulated owl habitat in the Silverfish PSU for the other combined action alternatives would range from 8 to 80 acres. All of the combined action alternatives would reduce PPI in the Crazy and Silverfish PSUs. Reductions in overall flammulated owl PPI in the KNF would range from 5 to 9 pairs. All combined action alternatives could impact individual flammulated owls and their habitat, but sufficient habitat would remain in the analysis area to support a large number of nesting pairs. Mitigation associated with combined agencies' alternatives would increase the proportion of designated old growth and promote the maintenance or development of flammulated owl habitat in the analysis area.

All of the combined action alternatives would include tree clearing within disturbance boundaries. Removal of large ponderosa pine or Douglas-fir trees and snags that provide potential nesting, feeding, singing, or roost sites could impact flammulated owls (Wright 1996). Given the existing snag levels (see section 3.24.2, *Key Habitats*), the loss of snags providing potential flammulated owl nesting habitat would have minor impacts on this owl. For the combined agencies' alternatives, implementation of the Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*) would minimize impacts to snags providing potential nesting and foraging habitat for flammulated owls, especially in the transmission line clearing area. If reclamation were successful and successional processes were allowed to take place, areas of disturbed flammulated owl habitat could potentially be restored to suitable habitat for this species in the long term.

In all combined action alternatives, noise from helicopters during line stringing and from other construction-related activities could cause flammulated owls to avoid nearby habitat, at least temporarily. Disturbance impacts from blasting and helicopters would be short-term and, with the exception of line maintenance activities, would cease after transmission line construction until decommissioning. Disturbance impacts during mine operations would probably be lower in intensity, but would last through the life of the mine.

Table 184. Flammulated Owl Habitat in the Analysis Area by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] No Mine Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Alternative		
		TL-B	TL-C	TL-D	TL-E	TL-C	TL-D	TL-E
Crazy PSU								
Flammulated Owl Habitat (acres)	11,902	11,535 (-367)	11,706 (-196)	11,701 (-201)	11,701 (-201)	11,682 (-220)	11,677 (-225)	11,677 (-225)
PPI[1] (pairs)	298	288	293	293	293	292	292	292
Silverfish PSU								
Flammulated Owl Habitat (acres)	10,786	10,778 (-8)	10,768 (-18)	10,786 (0)	10,706 (-80)	10,768 (-18)	10,786 (0)	10,706 (-80)
PPI[1] (pairs)	270	269	269	270	268	269	270	268
KNF								
Flammulated Owl Habitat (acres)	237,098	236,723 (-375)	236,884 (-214)	236,897 (-201)	236,817 (-281)	236,860 (-238)	236,873 (-225)	236,793 (-305)
PPI[1] (pairs)	5,927	5,918	5,922	5,922	5,920	5,922	5,922	5,920
Private and State Land								
Coniferous forest affected (acres)	0	18	67	73	58	67	73	58

Number in parentheses is the decrease in habitat acres compared to existing conditions.
[1] Based on an average flammulated owl home range size of 40 acres, rounded to nearest whole number. Due to rounding, KNF PPI may not be result of direct subtraction of PPI impacts displayed.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Although no active flammulated owl nests were identified in the analysis area during surveys conducted in 2005 (Westech 2005a), as specified in the Environmental Specifications (Appendix D) in all combined action alternatives, either tree removal would not occur during flammulated owl breeding season, or surveys would be conducted in potential flammulated owl habitat prior to project construction to identify potentially impacted nests. If an active nest were found in the project vicinity, tree removal would not occur in an avoidance area appropriate for the species until young have fledged. These measures would minimize potential impacts to nesting flammulated owls. Alternative 2B does not include timing restrictions or flammulated owl surveys of the mine disturbance area.

Impacts to coniferous forest on state and private land would range from 18 acres for Alternative 2B to 73 acres for Alternatives 3D and 4D. Because flammulated owl habitat on private land is highly fragmented, impacts of the combined action alternatives would be minimal.

Cumulative Effects

Past actions, particularly timber harvest, road construction, and fire-suppression activities, have altered the old growth ecosystems in the analysis area, resulting in a reduction in early and late succession habitats; conditions favoring shade-tolerant, fire-intolerant species; loss of large snags and down wood; increases in tree density; and a shift to a largely mid-seral structural stage (USDA Forest Service 2003b). Firewood cutting would continue to occur where open roads provide access to old growth habitat, contributing to the removal of snags important to flammulated owls. Continuing development of private lands, including timber harvest, home construction, and land clearing would contribute to losses of flammulated owl habitat in the analysis area. Impacts to flammulated owl on private and state lands would probably be minimal because it is highly fragmented due to high road densities and past timber harvest activities.

The Miller-West Fisher Vegetation Management Project would include regeneration harvest of about 475 acres, slash treatment of 681 acres, and prescribed burning of 3,751 acres of National Forest System lands in the Silverfish PSU. Timber harvest and other clearing activities planned for the Miller-West Fisher Vegetation Management Project would contribute to cumulative losses of snags important to flammulated owls in the Silverfish PSU. Activities associated with the Miller-West Fisher Vegetation Management Project are expected to retain cavity habitat within KFP-recommended levels for the Silverfish PSU. Regeneration harvest included in the Miller-West Fisher Vegetation Management Project, which would occur in the Silverfish PSU, would not directly affect old growth providing potential flammulated owl habitat. Also, while prescribed burns associated with the Miller-West Fisher Vegetation Management Project would consume some snags, it also would create snags by killing live trees. Snags and down wood created in burn areas would provide both feeding and nesting habitat for flammulated owls. Other reasonably foreseeable actions would involve minimal surface disturbance.

Alternative 1A would not contribute to cumulative losses of snags and would not contribute to cumulative effects on flammulated owl. While the combined action alternatives, in combination with other past, current, and reasonably foreseeable actions, would result in some losses and degradation of flammulated owl habitat and cumulative reductions in flammulated owl PPI in the analysis area, cumulative impacts on overall amounts of flammulated owl habitat would likely be minimal and would not likely affect populations in the KNF. Sufficient habitat would remain within the Crazy and Silverfish PSUs and the KNF to support existing populations. In addition, mitigation associated with combined agencies' alternatives would increase the proportion of

designated old growth and promote the maintenance or development of flammulated owl habitat in the analysis area.

Cumulative noise and other human-caused disturbances could occur as a result of the combined action alternatives and other reasonably foreseeable actions. Cumulative disturbance effects could affect individual flammulated owls, but would not likely affect flammulated owl populations in the KNF.

3.24.4.6.4 Regulatory/Forest Plan Consistency

KFP

The KNF is directed to "identify, protect, and manage" habitat for sensitive species in order to assist in maintaining viable populations. The KFP contains the following goals and direction for sensitive species: "determine the status of sensitive species and provide for their environmental needs as necessary to prevent them from becoming threatened or endangered" (KFP Vol. 1, II-1 #6); All alternatives would meet this KFP direction for the flammulated owl.

All action alternatives would require a project-specific amendment to allow harvest within designated old growth stands (MA 13). MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*. The project-specific amendment would change the current MA 13 (Old Growth) allocation of all harvested stands to either MA 23 (Electric Transmission Corridor) or MA 31 (Mineral Development). All action alternatives would be consistent with KFP direction to maintain a minimum of 10 percent old growth below 5,500 feet in elevation in each third order drainage or compartment, or a combination of compartments.

All alternatives are consistent with KFP direction for snags, snag replacement trees, and down wood (KFP Vol. 1, II-1 #8 and II-7; Vol. 2, Appendix 16). See section 3.24.2, *Key Habitats*.

National Forest Management Act

KFP direction is to "maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,… in sufficient quality and quantity to maintain viable populations" (KFP Vol. 1, II-1 #7). All combined action alternatives could impact individual flammulated owls and/or their habitat, but would not contribute to a trend toward federal listing or loss of species viability. This determination is based on: 1) the mine alternatives would have no impact on flammulated owls in the Silverfish PSU; 2) all combined action alternatives would result in the direct loss of flammulated owl habitat, but sufficient habitat would remain in the analysis area to support a large number of nesting pairs; 3) all action alternatives would result in an increase in habitat fragmentation, and a decrease in habitat effectiveness due to potential displacement; 4) no active flammulated owl nests were identified in the analysis area during surveys conducted in 2005 (Westech 2005a); 5) implementation of timing restrictions and pre-construction surveys included in the combined action alternatives would minimize potential impacts to nesting flammulated owls; 6) mitigation measures for the action alternatives and other actions, such as improvement harvest and prescribed burning, and habitat acquisitions and road access changes, would offset some of the impacts to flammulated owl habitat; 7) all combined mine-transmission line alternatives would be consistent with KFP direction to maintain a minimum of 10 percent old growth below 5,500 feet in elevation that may provide flammulated owl habitat; and 8) sufficient habitat within the Crazy and Silverfish PSUs and across the KNF would remain to support existing populations.

3.24.4.7 Townsend's Big-Eared Bat

3.24.4.7.1 Analysis Area and Methods

Townsend's big-eared bat population ecology, biology, habitat description, and relationships identified by research are described in Reel *et al.* (1989); Perkins and Schommer (1991); Kunz and Martin (1982); MNHP (1993); Christy and West (1993); Ross (1967); Whitaker *et al.* (1977); Thomas and West (1991); and Pierson *et al.* (1999). That information is incorporated by reference. Townsend's big-eared bat occurrence data come from recent District wildlife survey records and KNF historical data (NRIS FAUNA) and the MNHP.

The analysis area for project impacts to individuals and their habitat in the KNF is the Crazy and Silverfish PSUs. The analysis area for evaluating direct and indirect impacts of the transmission line on Townsend's big-eared bat on private and state land consists of all non-National Forest System lands that would be disturbed by any of the transmission line alternatives. The KNF and any non-National Forest System lands potentially disturbed by the alternative transmission line alignments is the analysis area for cumulative effects.

The impacts analysis includes an evaluation of the potential benefits to Townsend's big-eared bat from mitigation measures proposed by MMC or the agencies, such as implementation of the Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*), land acquisition associated with grizzly bear mitigation, and the designation of additional old growth habitat.

3.24.4.7.2 Affected Environment

Townsend's big-eared bats are known to feed along forest edges, and can be associated with either dry or wet type coniferous forests. Tree cavities provide potential roosting habitat for the Townsend's big-eared bat (Perkins and Schommer 1991; MNHP 1993), and preference is shown for old growth forest (Thomas and West 1991). Caves and mines are used as winter hibernacula, day and night roosts, and maternity roosts, and are important habitat for this species (USDA Forest Service 2003b). Young and mature forests are used for feeding (ibid.), with primary foraging areas near lakes (Grindal 1995). A KNF status summary of the Townsend's big-eared bat was documented by Johnson (1999). During surveys of the KNF conducted from 1993 to 1995 by Hendricks *et al.* (1995, 1996), the species was located in all planning units, but no key roosting sites such as caves or mines have been located. The bat population size on the KNF is unknown.

Observations recorded prior to 1997 by the District, Forest, and MNHP have documented the Townsend's big-eared bat within the Crazy and Silverfish PSUs, specifically at Howard Lake and in the Libby Creek Recreational Gold Panning Area on Libby Creek (Westech 2005a). Abandoned mines potentially providing hibernacula are known to exist within the Crazy and Silverfish PSUs, and include the Gloria, Copper Reward, and Snowshoe mines (Hargrave *et al.* 1999).

Larger diameter snags or trees in the analysis area could be used for summer roosting. As discussed in section 3.21, *Vegetation*, the Crazy PSU contains 16.3 percent designated effective old growth, and 19.0 percent total old growth acres, including both designated and undesignated old growth. The Silverfish PSU contains 10.2 percent designated effective old growth, and 12.7 percent total old growth acres. These stands and the remaining timbered habitat provide suitable roosting habitat in the form of large snags with cavities, as well as abundant foraging habitat across the forest landscape. As described for snag habitat, snag levels are greater than KFP-

recommended levels. Existing conditions for cavity habitat are also described for the pileated woodpecker in section 3.24.3, *Management Indicator Species*.

3.24.4.7.3 Environmental Consequences

Alternative 1 – No Mine

There would be no expected change in the existing condition with implementation of Alternative 1. On National Forest System lands, no direct effect to cavity habitat potential would occur, and the PPI for pileated woodpecker, the MIS for cavity habitat, would remain at 12 for the Crazy PSU and 11 for the Silverfish PSU. Impacts to the pileated woodpecker are described in section 3.24.3, *Management Indicator Species*.

Alternative 2 – MMC's Proposed Mine

In Alternative 2, no impacts to potential Townsend's big-eared bat habitat would occur in the Silverfish PSU. Harvest of old growth habitat and losses of other coniferous habitat associated with Alternative 2 would reduce and fragment available day-roosting habitat for the Townsend's big-eared bat in the Crazy PSU. Impacts to coniferous forest, old growth, and cavity habitat are described in sections 3.21, *Vegetation* and 3.24.3, *Management Indicator Species*. In Alternative 2, the KNF standards for minimum 10 percent old growth and for snag habitat would be met for both PSUs and the KNF. The PPI for pileated woodpecker, the MIS for cavity habitat, would not change as a result of Alternative 2. Disturbance or mortality of bats could occur if bats were using a snag that was cut down during construction. The loss of snags providing potential Townsend's big-eared bat roosting habitat resulting from Alternative 2 would have minor impacts on this bat, given the existing snag levels (see section 3.24.2, *Key Habitats*). Noise and other disturbances, such as blasting, construction of the plant and adit sites, road construction and use, and plant and adit operations could cause Townsend's big-eared bats to avoid nearby habitat, at least temporarily. Disturbance impacts would likely be greatest during the construction phase, but could persist through mine operations. Losses and degradation of old growth providing potential bat habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation, if bat habitat were present on the acquired parcels. Alternative 2 would not affect caves, mines, tunnels, or lakes in either the Crazy or Silverfish PSU. Although some individual Townsend's big-eared bats could be impacted by Alternative 2, given the availability of surrounding habitat, the proposed project would not be expected to reduce local bat populations. At mine closure, MMC would evaluate the feasibility of developing bat habitat in the adits by recessing the adit plug.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Impacts to Townsend's big-eared bat from Alternative 3 would be the same as Alternative 2, except that impacts to potential Townsend's big-eared bat habitat would be minimized through implementation of mitigation measures. The Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*) would minimize clearing and snag removal, and additional areas of old growth would be managed to retain or develop old growth characteristics. Also, the agencies' land acquisition program would likely be more effective at improving bat habitat because more land would be protected.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts to Townsend's big-eared bat from Alternative 4 would be the same as Alternative 3.

Alternative A – No Transmission Line

On National Forest System lands, Alternative A would not physically affect cavity habitat or the PPI for Townsend's big-eared bat.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

No direct impacts from Alternative B to old growth would occur in the Silverfish PSU. Harvest of old growth habitat associated with Alternative B would reduce available day-roosting habitat for Townsend's big-eared bat in the Crazy PSU. In Alternative B, the KNF standards for 10 percent old growth and for snag habitat would be met for both PSUs and the KNF. Alternative B would remove about 4 acres of old growth providing potential Townsend's big-eared bat habitat on private land along the Fisher River and a short portion of Miller Creek. Impacts to old growth is described in sections 3.21, *Vegetation* and 3.24.3, *Management Indicator Species*. Disturbance or mortality of bats could occur if bats were using a snag that was cut down during line construction. Clearing of old growth and snags would be minimized through implementation of the Environmental Specifications (Appendix D). Noise from helicopters during line stringing and from other construction-related activities could cause Townsend's big-eared bats to avoid nearby habitat, at least temporarily. Disturbance impacts would be short-term and, with the exception of line maintenance activities, would cease after transmission line construction. Alternative B would not affect caves, mines, tunnels, or lakes in either the Crazy or Silverfish PSU. Although some individual Townsend's big-eared bats could be impacted by Alternative B, given the availability of surrounding habitat, the proposed project would not be expected to reduce local Townsend's big-eared bat populations.

Alternative C – Modified North Miller Creek Transmission Line Alternative

Impacts to the Townsend's big-eared bat from Alternative C would be the same as Alternative B, except that impacts to potential Townsend's big-eared bat habitat also would be minimized through implementation of mitigation measures, such as the Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*), which would minimize clearing and snag removal, and designation of additional areas of old growth that would be managed to retain or develop old growth characteristics. Also, only 2 acres of old growth potentially providing bat habitat on private land would be impacted by Alternative C, as opposed to 4 acres for Alternative B.

Alternative D – Miller Creek Transmission Line Alternative

Impacts to the Townsend's big-eared bat from Alternative D would be the same as Alternative C.

Alternative E – West Fisher Creek Transmission Line Alternative

Impacts to the Townsend's big-eared bat from Alternative E would be the same as Alternative C, except that more old growth potentially providing bat habitat on private land would be impacted by Alternative E than Alternative C. About 6 acres of old growth would be impacted by Alternative E, as opposed to 2 acres for Alternative C.

Combined Mine-Transmission Line Effects

In all combined mine-transmission line alternatives, no impacts to potential Townsend's big-eared bat habitat would occur in the Silverfish PSU. Harvest of old growth habitat and losses of other coniferous habitat resulting from the combined action alternatives would reduce and fragment available day-roosting habitat for the Townsend's big-eared bat in the Crazy PSU. In all combined

mine-transmission line alternatives, the KNF standards for minimum 10 percent old growth and for snag habitat would be met for both PSUs and the KNF. Impacts to coniferous forest, old growth is described in sections 3.21, *Vegetation* and 3.24.3, *Management Indicator Species*. Disturbance or mortality of bats could occur if bats were using a snag that was cut down during construction. The loss of snags providing potential Townsend's big-eared bat roosting habitat resulting from the combined action alternatives would have minor impacts on this bat, given the existing snag levels (see section 3.24.2, *Key Habitats*). None of the combined mine-transmission line alternatives would affect caves, mines, tunnels, or lakes in either the Crazy or Silverfish PSU.

In all combined action alternatives, noise from helicopters during line stringing and from other construction-related activities could cause Townsend's big-eared bats to avoid nearby habitat, at least temporarily. Disturbance impacts from blasting and helicopters would be short-term and, with the exception of line maintenance activities, would cease after transmission line construction until decommissioning. Disturbance impacts during mine operations would probably be lower in intensity, but would last through the life of the mine.

Losses and degradation of old growth providing potential bat habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation in all combined action alternatives, if bat habitat were present on the acquired parcels, although the agencies' land acquisition program would likely be more effective at improving bat habitat than MMC's proposed program, because more land would be protected. All combined action alternatives would minimize the loss of old growth and snags in the transmission line clearing area through implementation of the Environmental Specifications (Appendix D). In all combined agencies' alternatives, impacts to potential Townsend's big-eared bat habitat also would be minimized through implementation of mitigation measures, such as the Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*) and the designation of additional areas of old growth that would be managed to retain or develop old growth characteristics (section 2.5.7.3.2, *Key Habitats*). At mine closure, MMC would evaluate the feasibility of developing bat habitat in the adits by recessing the adit plug.

Although some individual Townsend's big-eared bats could be impacted by the combined action alternatives, given the availability of surrounding habitat, the proposed project would not be expected to reduce local bat populations.

Cumulative Effects

Past actions, particularly timber harvest, road construction, and fire-suppression activities, have altered the old growth ecosystems in the analysis area, resulting in a reduction in early and late succession habitats; conditions favoring shade-tolerant, fire-intolerant species; loss of large snags and down wood; and increases in tree density and a shift to a largely mid-seral structural stage (USDA Forest Service 2003b). Firewood cutting would continue to occur where open roads provide access to old growth habitat, contributing removal of snags important to Townsend's big-eared bats. Continuing development of private lands, including timber harvest, home construction, and land clearing would contribute to losses of bat habitat in the analysis area. Impacts to Townsend's big-eared bats on private and state lands would probably be minimal because it is likely that limited amounts of old growth occur on private and state lands, based on past and current harvest practices. Alternative 1A would not have cumulative impacts on the Townsend's big-eared bat or its habitat.

Regeneration harvest included in the Miller-West Fisher Vegetation Management Project, which would occur in the Silverfish PSU, would not directly affect old growth providing potential Townsend's big-eared bat habitat. While the combined action alternatives, in combination with other past, current, and reasonably foreseeable actions, would result in some losses and degradation of bat habitat, cumulative impacts on overall amounts of old growth would likely be minimal. In addition, mitigation associated with combined agencies' alternatives would increase the proportion of designated old growth and promote the maintenance or development of old growth providing Townsend's big-eared bat habitat in the analysis area.

Cumulative noise and other disturbances could occur as a result of the combined action alternatives and other reasonably foreseeable actions. Cumulative disturbance effects could affect individual Townsend's big-eared bats, but would not likely affect their populations in the KNF.

Cumulatively, the timber harvest activities on public and private lands and the removal of dead standing trees, as well as the removal of live trees with cavities (depending on their diameter) could reduce potential summer roosting sites for the Townsend's big-eared bat in other parts of the analysis area. No direct cumulative effects on key hibernacula would occur because no caves or mines are known to occur in either the Crazy or Silverfish PSU.

None of the action alternatives would change the existing PPI for the MIS for cavity-nesting species, and would not likely contribute to cumulative effects on Townsend's big-eared bats or their habitat. The existing snag levels are greater than KFP-recommended levels. Cumulatively, with all other reasonably foreseeable actions on private and corporate lands considered, sufficient cavity habitat would remain in the Crazy and Silverfish PSUs and the KNF to maintain existing Townsend's big-eared bat populations.

3.24.4.7.4 Regulatory/Forest Plan Consistency

KFP

The KNF is directed to "identify, protect, and manage" habitat for sensitive species in order to assist in maintaining viable populations. The KFP contains the following goals and direction for sensitive species: "determine the status of sensitive species and provide for their environmental needs as necessary to prevent them from becoming threatened or endangered" (KFP Vol. 1, II-1 #6). All alternatives would meet this KFP direction for the Townsend's big-eared bat.

All action alternatives would require a project-specific amendment to allow harvest within designated old growth stands (MA 13). MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*. The project-specific amendment would change the current MA 13 (Old Growth) allocation of all harvested stands to either MA 23 (Electric Transmission Corridor) or MA 31 (Mineral Development). All action alternatives would be consistent with KFP direction to maintain a minimum of 10 percent old growth below 5,500 feet in elevation in each third order drainage or compartment, or a combination of compartments.

All alternatives are consistent with KFP direction for snags, snag replacement trees, and downed wood (KFP Vol. 1, II-1 #8 and II-7; Vol. 2, Appendix 16). See section 3.24.2, *Key Habitats*.

National Forest Management Act

KFP direction is to "maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,… in sufficient quality and quantity to maintain viable

populations" (KFP Vol. 1, II-1 #7). All combined action alternatives could impact individual Townsend's big-eared bats and/or their habitat, but would not contribute to a trend toward federal listing or loss of species viability. This determination is based on: 1) none of the combined mine-transmission line alternatives would affect key hibernacula, because no caves or mines are known to occur in either the Crazy or Silverfish PSU; 2) timber harvest activities associated with the combined action alternatives would reduce potential summer roosting sites for the Townsend's big-eared bat, but impacts would be too small to change the existing PPI for pileated woodpecker, the MIS for cavity-nesting species; and 3) snag levels would continue to be greater than KFP-recommended levels and sufficient cavity habitat would remain in the Crazy and Silverfish PSUs and the KNF to maintain existing Townsend's big-eared bat populations; and 4) a forested environment suitable for foraging would remain well distributed across the Crazy and Silverfish PSUs and the KNF.

3.24.4.8 Western Toad

3.24.4.8.1 Analysis Area and Methods

Western toad ecology, biology, habitat use, status, and conservation are described and summarized in Maxell (2000) and Reichel and Flath (1995). That information is incorporated by reference. Western toad occurrence data come from District wildlife observation records and KNF historical data (NRIS FAUNA) and other agencies (MNHP).

Criteria used to compare the alternative impacts on the western toad and its habitat includes impacts to known breeding/rearing habitat, potential breeding habitat, and potential upland foraging habitat. In the analysis area, potential breeding habitat is represented by wetlands and aquatic habitat, as described in section 3.22, *Wetlands and Other Waters of the U.S.* Upland foraging habitat is represented in the KNF by habitat providing cover, as described for the deer and elk analyses, which includes riparian habitat not already included in breeding habitat. For private and state land, upland foraging habitat is represented by unharvested coniferous forest, as described in section 3.21, *Vegetation*. Although some harvested areas may provide upland foraging habitat, data were not available to evaluate habitat conditions in these areas at this level of detail. For this analysis, it was assumed that harvested areas do not provide potential habitat.

The analysis area for project impacts to individuals and their habitat in the KNF is the Crazy and Silverfish PSUs. The analysis area for evaluating direct and indirect impacts of the transmission line on western toads on private and state land consists of all non-National Forest System lands that would be disturbed by any of the transmission line alternatives. The KNF and any non-National Forest System lands potentially disturbed by the alternative transmission line alignments is the analysis area for cumulative effects.

The impacts analysis includes an evaluation of the potential benefits to western toads from mitigation measures proposed by MMC or the agencies, such as implementation of the Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition)*, wetlands mitigation, fisheries mitigation, KNF riparian standards and guidelines, and water quality standards.

3.24.4.8.2 Affected Environment

Western toads require over-wintering, breeding/rearing, and foraging habitat, and may also be dependent on habitats suitable for migration if the three required habitat types are isolated spatially (Maxell 2000). Over-wintering may take place in underground caverns or in rodent

burrows, breeding/rearing takes place in aquatic sites such as shallow areas of large and small lakes or temporary ponds, and foraging habitat consists largely of terrestrial uplands (ibid.). In Montana, the species has been documented to occur as high as 9,220 feet in elevation.

Quantitative data regarding the western toad's use of upland and forested habitats is limited. Western toads are known to migrate between the aquatic breeding and terrestrial non-breeding habitats (NatureServe 2007). Movement of toads between breeding sites has been documented from 1.6 miles to greater than 3 miles (Corn *et al.* 1998; Bartelt and Peterson 1994). Movement in foraging areas may be influenced by the distribution of shrub cover, and toads may avoid habitats with low canopy closure and shrub cover, such as clearcuts (Bartelt and Peterson 1994). Down wood may be important in providing refugia for this species (ibid.).

According to the KNF status summary of the western toad (Johnson 1999), the species has been found in seven of the eight planning units in the KNF. The population size is unknown and direct measures of population trend on the KNF are not available (Johnson 1999). About 35 breeding sites were verified in the KNF between 1995 and 1998 (ibid.).

Results of annual District surveys have not identified any breeding sites in the Crazy or Silverfish PSUs (Johnson 1999). Observation from the late 1980s and early 1990s suggest that western toad breeding may be present in the Little Cherry Creek drainage (Westech 2005a). In August 2007, one adult western toad was found in the Poorman Tailings Impoundment Site in the Crazy PSU (Geomatrix 2007e). Potential breeding habitat is present in the Crazy and Silverfish PSUs in aquatic and wetland habitats, including temporal ponds or road ditches. Upland terrestrial habitat providing relatively good shrub or forest cover within the Crazy and Silverfish PSUs is considered potential foraging habitat. About 62,751 and 66,467 acres of upland terrestrial western toad habitat occur in the Crazy and Silverfish PSUs, respectively.

The majority of the non-National Forest System lands in the analysis area have high road densities and have been logged in the past 20 to 30 years, resulting in fragmented coniferous. Vegetation communities in the analysis area, including private and state land, are shown on Figure 83.

3.24.4.8.3 Environmental Consequences

Impacts to western toads from mine and transmission line alternatives are shown in Table 185 and Table 186 and are described in the following subsections.

Alternative 1 – No Mine

Alternative 1 would not affect the western toad.

Alternative 2 – MMC's Proposed Mine

Alternative 2 would result in an increased risk of incidental mortality of western toads. Alternative 2 would result in disturbance to about 37 acres of wetland habitat providing potential breeding habitat for the western toad (Table 185). All wetlands affected would be replaced with wetlands with similar functions and values. Impacts to wetlands are described in section 3.22, *Wetlands and Other Waters of the U.S.* This loss would be mitigated through implementation of MMC's Wetland Mitigation Plan (see section 2.4.6.1, *Wetland Mitigation Plan*).

Table 185. Impacts to Western Toad Habitat in the Analysis Area by Mine Alternative.

Measurement Criteria	[1] No Mine	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment	[4] Agency Mitigated Little Cherry Creek Impoundment
Potential breeding habitat impacted[1] (acres)	0	37	14	37
Upland foraging habitat impacted[2] (acres)	0	2,197	1,811	1,895

[1] Potential breeding habitat is represented by wetlands and aquatic habitat as described in section 3.22, *Wetlands and Other Waters of the U.S.*
[2] Habitat providing cover, as described for white-tailed deer and elk. Includes riparian habitat not already included in breeding habitat.
Source: GIS analysis by ERO Resources Corp. using KNF data and vegetation mapping in Westech 2005d and MMI 2005b.

Table 186. Impacts to Western Toad Habitat in the Analysis Area by Transmission Line Alternative.

Measurement Criteria	[A] No Transmission Line/Existing Conditions	[B] MMC's Proposed Transmission Line (North Miller Creek	[C] Modified North Miller Creek Transmission Line	[D] Miller Creek Transmission Line	[E] West Fisher Creek Transmission Line
Crazy and Silverfish PSUs					
Potential breeding habitat impacted[1] (acres)	0	10	3	13	12
Upland foraging habitat impacted[2] (acres)	0	189	175	178	243
Private and State Land					
Potential breeding habitat impacted[1] (acres)	0	9	2	2	17
Upland foraging habitat impacted[2] (acres)	0	18	67	73	58

[1] Potential breeding habitat in KNF is represented by wetlands and aquatic habitat as described in section 3.22, *Wetlands and Other Waters of the U.S.* Potential breeding habitat on private and state land is represented by wetland/riparian habitat as described in section 3.22, *Wetlands and Other Waters of the U.S.*
[2] In KNF consists of habitat providing cover, as described for white-tailed deer and elk. Includes riparian habitat not already included in breeding habitat. For private and state land includes unharvested coniferous forest, as described in section 3.21, *Vegetation.*
Source: GIS analysis by ERO Resources Corp. using KNF data and vegetation mapping in Westech 2005d and MMI 2005b.

About 2,197 acres of upland foraging habitat would be disturbed by Alternative 2 (Table 185). Impacted habitat would represent about 4 percent of the total foraging habitat available. Some down wood and wintering habitat also would be lost as a result of Alternative 2. Relative to existing habitat and down wood, these losses would have minor impacts on the western toad.

The fragmentation of natural habitats from timber harvesting and road building may impede dispersal and decrease the probability of wetland recolonization by amphibians (Semlitsch 2000). Western toads are considered terrestrial habitat generalists (deMaynadier and Hunter 1998) and tend to be more tolerant than some amphibians of forest edges, tree harvests, and declining patch size (Renken *et al.* 2004).

A review of the available literature by Semlitsch (2000) indicates timber harvest and road construction activities can impact aquatic breeding habitat by altering the hydrological cycle of wetlands, which can impair completion of larval metamorphosis through early pond drying, or result in increased predation if ponds persist longer. Aquatic habitat quality can also be reduced as a result of increased sedimentation and water temperatures. In Alternative 2, indirect impacts to aquatic habitat from increased sedimentation would be minor, and would be minimized through implementation of erosion control BMPs. Increases in water temperature as a result of Alternative 2 are not anticipated. Mine inflows, discharges, and stream diversions projected for Alternative 2 may change lake levels and streamflows, potentially impacting western toad habitat. Impacts to water quantity and quality and aquatic habitat are described in sections 3.12, *Surface Water Quality* and 3.6, *Aquatic Life and Fisheries*.

Fisheries mitigation, especially habitat improvement in Libby Creek, and wetland mitigation, such as the creation of new wetlands, would offset some of the potential impacts of Alternative 2 on western toad breeding habitat. Impacts to aquatic habitat would be minimized through implementation of KNF riparian standards and guidelines, as amended by the INFS (USDA Forest Service 1995). Impacts to water quantity and quality and aquatic habitat are described in sections 3.12, *Surface Water Quality* and 3.6, *Aquatic Life and Fisheries*.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Impacts to western toad from Alternative 3 would be less than Alternative 2, affecting less wetland habitat (14 acres) and less upland foraging habitat (1,811) (Table 185). Also, implementation of the agencies' Wetland Mitigation Plan and Vegetation Removal and Disposition Plan (sections 2.4.6.1, *Wetland Mitigation Plan* and 2.5.3.2.1, *Vegetation Removal and Disposition*) also would minimize impacts to wetlands.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts to western toad from Alternative 4 would be less than Alternative 2, affecting less upland foraging habitat (1,895 acres) (Table 185).

Alternative A – No Transmission Line

Table 186 summarizes the impacts to western toad habitat due to each alternative. Alternative A would not affect the western toad.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

The clearing area for Alternative B would include about 10 acres of western toad breeding habitat in the Crazy and Silverfish PSUs and 9 acres of western toad breeding habitat on private land

(Table 186). Impacts to wetlands are described in section 3.22, *Wetlands and Other Waters of the U.S.*

About 189 acres of upland foraging habitat in the Crazy and Silverfish PSUs and 18 acres of upland foraging habitat on private land would be disturbed by Alternative B (Table 186), which represents less than 1 percent of the total foraging habitat available. Some down wood and wintering habitat also would be lost as a result of Alternative B. Relative to existing habitat and availability of down wood, these losses would have minor impacts on the western toad.

Alternative B includes the construction of about 10 miles of new access roads; sedimentation from new road construction would be minimized through implementation of erosion control BMPs.

The fragmentation of natural habitats from timber harvesting and road building may impede dispersal and decrease the probability of wetland recolonization by amphibians (Semlitsch 2000). Alternative B includes the construction of about 10 miles of new access roads, which would contribute to fragmentation of western toad upland foraging habitat. Western toads are considered terrestrial habitat generalists (deMaynadier and Hunter 1998), and tend to be more tolerant than some other amphibians of forest edges, tree harvests, and declining patch size (Renken *et al.* 2004).

Impacts to western toad breeding habitat would be minimized through implementation of MMC's Wetland Mitigation Plan (section 2.4.6.1, *Wetland Mitigation Plan*), and the Environmental Specifications (Appendix D).

Alternative C – Modified North Miller Creek Transmission Line Alternative

Impacts to the western toad from Alternative C would be less than Alternative B, affecting less breeding habitat. The clearing area for Alternative C would include about 3 acres of breeding habitat in the Crazy and Silverfish PSUs and 2 acres of breeding habitat on private land providing potential breeding habitat. Slightly less upland foraging habitat would be disturbed by Alternative C than Alternative B in the Crazy and Silverfish PSUs (178 acres instead of 189 acres), while more upland foraging habitat would be impacted on private land (67 acres instead of 18 acres) (Table 186). Also, fewer miles of new access roads would be constructed for Alternative C than Alternative B (3 miles instead of 10 miles), and the potential for stream sedimentation would be lower. Implementation of the agencies' Wetland Mitigation Plan and the Vegetation Removal and Disposition Plan (sections 2.4.6.1, *Wetland Mitigation Plan* and 2.5.3.2.1, *Vegetation Removal and Disposition*), and the Environmental Specifications (Appendix D) also would minimize impacts to western toad breeding habitat.

Alternative D – Miller Creek Transmission Line Alternative

Alternative D would disturb more western toad breeding habitat in the Crazy and Silverfish PSUs than Alternative B. The clearing area for Alternative D would include about 13 acres of breeding habitat in the Crazy and Silverfish PSUs. Slightly more upland foraging habitat would be disturbed by Alternative D than Alternative B (178 acres instead of 175 acres in the Crazy and Silverfish PSUs, and 73 acres instead of 67 acres on private land) (Table 186). Also, fewer miles of new access roads would be constructed for Alternative D than Alternative B (3 miles instead of 10 miles), and the potential for stream sedimentation would be lower.

Alternative E – West Fisher Creek Transmission Line Alternative

Impacts to the western toad from Alternative E would be the same as Alternative D, except that 1 more mile of new access roads would be constructed and more upland habitat would be impacted in the Crazy and Silverfish PSUs (243 acres instead of 178 acres). Alternative E would impact more western toad habitat on private and state land than Alternative D, including 17 acres of western toad breeding habitat and 58 acres of upland foraging habitat. The potential for stream sedimentation would be essentially the same for Alternatives D and E.

Combined Mine-Transmission Line Effects

Impacts to western toad habitat for combined mine-transmission line alternatives are displayed in Table 187 and described below.

Table 187. Impacts to Western Toad Habitat in the Analysis Area by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] No Mine Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Alternative		
		TL-B	TL-C	TL-D	TL-E	TL-C	TL-D	TL-E
Crazy and Silverfish PSUs								
Potential breeding habitat impacted[1] (acres)	0	32	15	24	24	29	38	38
Upland foraging habitat impacted[2] (acres)	0	2,386	1,986	1,989	2,054	2,070	2,073	2,138
Private and State Land								
Potential breeding habitat impacted[1] (acres)	0	9	2	2	17	2	2	17
Upland foraging habitat impacted[2] (acres)	0	18	67	73	58	67	73	58

[1] Potential breeding habitat in KNF is represented by wetlands and aquatic habitat as described in section 3.22, *Wetlands and Other Waters of the U.S.* Potential breeding habitat on private and state land is represented by wetland/riparian habitat as described in section 3.22, *Wetlands and Other Waters of the U.S.*

[2] In KNF consists of habitat providing cover, as described for white-tailed deer and elk. Includes riparian habitat not already included in breeding habitat. Private and state land includes unharvested coniferous forest, as described in section 3.21, *Vegetation*.

Source: GIS analysis by ERO Resources Corp. using KNF data and vegetation mapping in Westech 2005d and MMI 2005b.

Alternatives 4D and 4E would affect the most western toad breeding habitat in the Crazy and Silverfish PSUs, resulting in impacts to 38 acres. Alternatives 3D and 4D would affect the most western toad breeding habitat on state and private land, affecting 17 acres (Table 187). Alternative 3C would have the least impact on western toad breeding habitat, affecting 15 acres in the Crazy and Silverfish PSUs and 2 acres on private and state land. Upland foraging habitat in the Crazy and Silverfish PSUs would be affected the most by Alternative 2B, impacting 2,386 acres.

Alternatives 3D and 4D would affect the most upland foraging habitat on state and private land, impacting about 73 acres. In all combined action alternatives, implementation of Wetland Mitigation Plans (section 2.4.6.1, *Wetland Mitigation Plan*) and the Environmental Specifications (Appendix D) would minimize impacts to western toad breeding habitat. The agencies' alternatives also would minimize impacts through implementation of the Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*).

The fragmentation of natural habitats from timber harvesting and road building may impede dispersal and decrease the probability of wetland recolonization by amphibians (Semlitsch 2000). Alternative 2B would include the most new road construction (about 11.7 miles). New road construction for the combined agencies' alternatives would be comparable, ranging from 4.7 miles for Alternatives 3C, 3D, 4C, and 4D to 5.7 miles for Alternatives 3D and 3E. Western toads are considered terrestrial habitat generalists (deMaynadier and Hunter 1998), and tend to be more tolerant than some amphibians of forest edges, tree harvests, and declining patch size (Renken *et al.* 2004). New road construction, while it may affect individual western toads, would not affect the western toad population in the analysis area.

Cumulative Effects

Past actions, particularly timber harvest, road construction, and fire-suppression activities, have altered the old growth ecosystems in the analysis area, resulting in a reduction in early and late succession habitats; conditions favoring shade-tolerant, fire-intolerant species; loss of large snags and down wood; increases in tree density; and a shift to a largely mid-seral structural stage (USDA Forest Service 2003b). Continuing development of private lands, including timber harvest, home construction, and land clearing, would contribute to losses of western toad habitat in the analysis area.

Timber harvest and other clearing activities planned for the Miller-West Fisher Vegetation Management Project would contribute to cumulative losses of upland foraging habitat for western toads in the Silverfish PSU. The Miller-West Fisher Vegetation Management Project would include regeneration harvest of about 475 acres, slash treatment of 681 acres, and prescribed burning of 3,751 acres of National Forest System lands in the Silverfish PSU. In the short term, slash and/or burn units would not provide habitat until shrub cover returned (2 to 3 years). Other reasonably foreseeable actions would involve minimal surface disturbance.

Alternative 1A would not contribute to cumulative losses of western toad habitat. While the combined action alternatives, in combination with other past, current, and reasonably foreseeable actions, would result in some losses and degradation of western toad habitat in the analysis area, sufficient habitat would remain within the Crazy and Silverfish PSUs and the KNF to support existing populations.

Road construction and improvements would occur for other reasonably foreseeable actions, including the Miller-West Fisher Vegetation Management Project, several mine and private property access projects, and forest road maintenance and improvement. The construction of new roads and the improvement of existing roads associated with the combined action alternatives, in combination with other reasonably foreseeable actions, could result in an increased risk of incidental mortality of western toads due to increased traffic volumes; fragmentation of upland habitat; to a lesser degree, breeding habitat; and increased sedimentation and decreased quality of aquatic habitat in the analysis area. For the mine alternatives, mine inflows, discharges, and stream diversions associated with the mine alternatives and other reasonably foreseeable mines,

in particular the Rock Creek Project, could result in cumulative changes in lake levels, spring flows, and streamflows, potentially impacting western toad breeding habitat. Cumulative impacts to water quantity and quality and aquatic habitat are described in sections 3.12, *Surface Water Quality* and 3.6, *Aquatic Life and Fisheries*.

Mitigation associated with the action alternatives and other reasonably foreseeable actions would offset some of the potential cumulative impacts to the western toad. Mitigation measures would include wetlands creation, habitat improvement in Libby Creek, road access changes, and habitat acquisitions.

3.24.4.8.4 Regulatory/Forest Plan Consistency

KFP

The KNF is directed to "identify, protect, and manage" habitat for sensitive species in order to assist in maintaining viable populations. The KFP contains the following goals and direction for sensitive species: "determine the status of sensitive species and provide for their environmental needs as necessary to prevent them from becoming threatened or endangered" (KFP Vol. 1, II-1 #6); All alternatives would meet this KFP direction for the western toad. All alternatives are consistent with KFP riparian standards and guidelines (KFP Vol. 1, II-28 thru 33) as amended by INFS.

National Forest Management Act

KFP direction is to "maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,… in sufficient quality and quantity to maintain viable populations" (KFP Vol. 1, II-1 #7). All combined action alternatives could impact individual western toads and their habitat, but would not contribute to a trend toward federal listing or loss of species viability. This determination is based on: 1) the combined action alternatives would affect between 17 and 45 acres of potential western toad breeding habitat (wetlands); 2) in all combined action alternatives, implementation of Wetland Mitigation Plan (section 2.4.6.1, *Wetland Mitigation Plan*) and the Environmental Specifications (Appendix D) would minimize impacts to western toad breeding habitat; the agencies' alternatives also would minimize impacts through implementation of the Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*); 3) the combined action alternatives would affect between 2,053 and 2,404 acres of upland foraging habitat; 4) all combined action alternatives would result in an increase in habitat fragmentation and increased mortality risk due to higher traffic volumes; and 5) sufficient large downed wood habitat would remain to provide refugia, and sufficient cover would remain in the Crazy and Silverfish PSUs and the KNF to maintain existing western toad populations.

3.24.4.9 Wolverine

3.24.4.9.1 Analysis Area and Methods

Wolverine population ecology, biology, habitat description, and relationships identified by research are described in Banci (1994) and Butts (1992). That information is incorporated by reference. Wolverine occurrence data come from recent District wildlife observation records, KNF historical data (NRIS FAUNA), and FWP. Wolverines are habitat generalists for all activities except for denning; the impacts analysis was based on denning habitat only. Potential wolverine denning habitat was estimated based on KNF CEM and TSMRS vegetation data and the KNF CEM wolverine denning habitat model (see KNF project record).

Wolverines are sensitive to human disturbance (Butts 1992; Thomas 1995; Copeland 1996; Weaver *et al.* 1996; Witmer *et al.* 1998; Joslin and Youmans 1999). Distances that wildlife species are displaced due to human activity vary, but in general, impacts for most species may occur up to 0.33 mile or the nearest ridgeline from the source of disturbance (Christensen and Madel 1982; Schirato 1989; Frederick 1991; Grant *et al.* 1998; Austin 1998), and may extend up to 1 mile, depending on type of disturbance (Bury 1983; USDA Forest Service 1988a; IGBC 1990). In absence of species-specific data, the influence zones suggested for grizzly bear in the grizzly bear Cumulative Effects Model (USDA Forest Service 1988a) were used to estimate the displacement effects of disturbances associated with mine construction and operations on wolverines. Wolverines are most sensitive to human disturbance during the denning period (December 1 to April 30) (Copeland 1996).

The analysis area for direct, indirect, and cumulative project impacts to individuals and their habitat and consists of the Crazy and Silverfish PSUs. Wolverine habitat does not occur on private land within the zone of influence of the proposed project.

The impacts analysis includes an evaluation of the potential benefits to wolverines from mitigation measures proposed by MMC or the agencies, such as habitat acquisitions and access changes planned as mitigation for the impacts to grizzly bear and big game security, and prohibiting employees from carrying firearms.

3.24.4.9.2 Affected Environment

The wolverine is a very secretive animal generally associated with remote areas (Hash 1987). Wolverines usually occupy higher elevations in summer and lower elevations in winter in northwestern Montana (MNHP 2008). The wolverine usually requires large tracts of wilderness and is sensitive to habitat fragmentation (Banci 1994). Wolverines are primarily scavengers and generally do not hunt for their own food. While wolverines appear to be relative generalists in selection of habitat for most activities, female wolverines are more selective in their choice of natal denning sites, preferring high elevation, snowy cirque basins, where they could dig through deep snow for protective cover for their young. Female wolverines are very sensitive to disturbance during the denning period. Denning habitat is widely available at the highest elevations on the KNF, but not common except in certain areas, such as the CMW.

Ruediger (1994) shows the KNF as a primary habitat area for wolverine. Johnson (1999) shows wolverine presence confirmed in seven of the eight planning units on the KNF. Wolverines and their signs have been recently documented in the Crazy and Silverfish PSUs. A wolverine was photographed in the upper Libby Creek drainage in 2006, and another videotaped in the Ramsey Creek drainage in 2007 (Brown, pers. comm. 2008; Williams, pers. comm. 2008). Wolverine tracks were documented in the upper Bear Creek drainage in 1995 and 2001 during winter track surveys conducted by FWP of the Snowshoe, Leigh, Big Cherry, Bear, and Poorman creek drainages (see KNF project record). In the Silverfish PSU, there have been 18 track observations and two visual sightings of wolverines from 1984 to present (one in the Porcupine Creek drainage and one in the Baree Creek drainage). Eleven sets of wolverine tracks and one potential den site have been documented along the Baree Lake Trail during annual or biannual surveys conducted by the Forest Service since 1989 (ibid.).

Based on habitat modeling, 4,118 acres of denning habitat occur in the Crazy PSU and 2,374 acres of denning habitat occur in the Silverfish PSU. Following the identification process outlined in Ruediger (1994), the Kootenai and Fisher PSUs are designated as secondary wolverine

conservation areas (Johnson 2004b). The Crazy and Silverfish PSUs are within a high-quality wolverine habitat area (ibid.). About 46,439 acres of potential wolverine denning habitat occur on the KNF (Johnson 1999).

3.24.4.9.3 Environmental Consequences

Of all mine and transmission line alternatives, only Alternative E would result in physical disturbance of wolverine denning habitat, impacting 2 acres. Impacts on wolverines from human activities associated with the transmission line alternatives and combined mine-transmission line alternatives are shown in Table 188 and Table 189 and described in the following subsections. The analysis of the effects of human activity on wolverines is based on activity-specific buffers, and includes the effects of open roads. Road access changes associated with mitigation were determined for combined mine-transmission line alternatives. It is not possible to attribute these road access changes to individual mine and transmission line alternatives independent of one another. Because the disturbance buffer applied to new or opened roads associated with the transmission line is encompassed entirely by the buffer applied to helicopter disturbance, effects of human activity during transmission line construction are calculated based on the area of overlap between the helicopter disturbance buffer and wolverine denning habitat. It is assumed that human disturbance would not affect wolverines during transmission line operations. The evaluation of the effects of human activity on wolverines from individual mine alternatives may be inferred from impact calculations for the combined mine-transmission line alternatives shown in Table 189.

Alternative A – No Transmission Line

Alternative A would have no effect on wolverine habitat.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Alternative B would have no physical impacts on wolverine denning habitat. During the construction phase of Alternative B, habitat affected by human disturbance would increase by about 120 acres in the analysis area, mostly in the Ramsey Creek area due to line stringing conducted by helicopters (Table 188). Disturbance effects from helicopter line stringing would be short-term (10 days) and would be greatest if they occurred during the wolverine denning period. Disturbance effects could also occur from other transmission line construction activities in areas where helicopters were not used. Except for annual inspection and infrequent maintenance operations, helicopter and other transmission line construction activities would cease after transmission line construction until decommissioning. Helicopter use and other activities could result in short-term disturbance of wolverines during line decommissioning.

Alternative C – Modified North Miller Creek Transmission Line Alternative

Alternative C would have no physical impacts on wolverine denning habitat. During the construction phase of Alternative C, habitat affected by human disturbance would increase by about 10 acres in the analysis area, mostly due to line stringing conducted by helicopters at the mouth of the Libby Creek drainage (Table 188). In Alternative C, helicopters would be used in some segments for vegetation clearing and structure placement, as well as stringing the entire line, extending the duration of disturbance by about 2 months. Disturbance effects from helicopter use and other construction activities would be greatest if they occurred during the wolverine denning period. In Alternative C, except for annual inspection and infrequent

Table 188. Human Disturbance Effects on Wolverine in the Analysis Area by Transmission Line Alternative.

Habitat Component	[A] No Transmission Line/Existing Conditions	[B] MMC's Proposed Transmission Line (North Miller Creek Alternative)		[C] Modified North Miller Creek Transmission Line Alternative		[D] Miller Creek Transmission Line Alternative		[E] West Fisher Creek Transmission Line Alternative	
		Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]
Habitat Affected by Human Activity in Analysis Area[3, 4] (acres)	136	256 (120)	136 (0)	146 (10)	136 (0)	146 (10)	136 (0)	146 (10)	136 (0)

Number shown in parentheses is the increase (in acres) compared to existing conditions.
[1] Const = during transmission line construction.
[2] Ops = during mine operations.
[3] Acres affected by human activity do not include areas of overlap from different sources of disturbance. Human disturbance was calculated by applying the following buffers:
Open roads (including seasonally open roads that are open during bear year from April 1 to Nov. 30) = 0.25 mile on each side.
Helicopter construction = 1 mile on each side of disturbance.
[4] For Alternative B, the use of helicopters during line construction would be at the discretion of MMC. For this analysis, it is assumed that helicopters would not be used during construction or structure placement for Alternative B. Helicopter use was assumed for line stringing only.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 189. Human Disturbance Effects on Wolverine in the Analysis Area by Combined Mine-Transmission Line Alternative.

Habitat Component	[1] No Mine Existing Condition	[2] MMC's Proposed Mine		[3] Agency Mitigated Poorman Impoundment Alternative						[4] Agency Mitigated Little Cherry Creek Impoundment Alternative					
	TL-A	TL-B		TL-C		TL-D		TL-E		TL-C		TL-D		TL-E	
		Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]
Indirect Disturbance in Analysis Area[3,4] (acres)	136	1,015 (+879)	376 (+240)	922 (+786)	374 (+238)	922 (+786)	374 (+238)	922 (+786)	374 (+238)	922 (+786)	374 (+238)	922 (+786)	374 (+238)	922 (+786)	374 (+238)

Number shown in parentheses is the increase (in acres) compared to existing conditions.
[1] Const = during project construction.
[2] Ops = during project operations.
[3] Acres affected by human activity do not include areas of overlap from different sources of disturbance. Human disturbance effects were calculated by applying the following buffers:
Open roads (including seasonally open roads that are open during bear year from April 1 to Nov. 30) = 0.25 mile on each side.
Helicopter construction = 1 mile on each side of disturbance.
[4] For Alternative 2B, the use of helicopters during line construction would be at the discretion of MMC. The agencies assumed that helicopters would not be used during vegetation clearing or structure placement for Alternative 2B. Helicopter use was assumed for line stringing only.
Source: GIS analysis by ERO Resources Corp. using KNF data.

maintenance operations, helicopter use and other transmission line construction activities would cease after transmission line construction until decommissioning, similar to Alternative B.

Alternative D – Miller Creek Transmission Line Alternative

Impacts to the wolverine from Alternative D would be the same as Alternative C.

Alternative E – West Fisher Creek Transmission Line Alternative

Alternative E would physically impact about 2 acres of wolverine denning habitat. Human disturbance impacts from Alternative E would be the same as Alternative C.

Combined Mine-Transmission Line Effects

The effects of the combined mine-transmission line alternatives on wolverine are shown in Table 189 and summarized below.

Of the combined mine-transmission line alternatives, only Alternatives 3E and 4E would physically impact wolverine denning habitat, resulting in the physical disturbance of 2 acres. As a result of Ramsey Plant site activities, disturbance to wolverines from human activity during the construction phase would be the greatest in Alternative 2B, resulting in human disturbance impacts to 1,015 acres (Table 189). Combined agencies' alternatives could disturb 922 acres of wolverine denning habitat during the construction phase. Disturbance during construction would include surface blasting associated with construction of the adits and helicopter use during line stringing and would be short-term. Disturbance from helicopter use and other transmission line construction activities are described above for Alternatives B and C.

Blasting would likely be mostly underground at the Libby Adit, where a maximum of two rounds of blasting would occur at the surface. The Ramsey Adits would probably require a maximum of two rounds of surface blasting per adit. The ventilation raise would be constructed from inside the mine and would not require any surface blasting, except for creation of the surface opening. Construction of the Ramsey Adits for Alternative 2B and the lower and upper Libby Adits for the combined agencies' alternatives is expected to take about 1 year. The construction phase for all combined action alternatives is expected to last 2 to 3 years. During operations, human disturbance impacts would be essentially the same in all combined action alternatives, affecting between 374 and 376 acres. For all combined action alternatives, some disturbance effects would be offset by access changes (installation of gates or barriers and public access restrictions) and habitat acquisitions planned as mitigation for the impacts to grizzly bear and big game security. The combined agencies' alternatives would include more road access changes and more habitat acquisition, and would more effectively mitigate potential effects of disturbance to wolverines. In all combined action alternatives, the risk of wolverine mortality would increase as a result of increased access to wolverine habitat. All combined action alternatives would include snowplowing Bear Creek Road (NFS road #278) and Libby Creek Road (NFS road #231) during the evaluation program and while the Bear Creek Road is reconstructed, providing trappers easy winter access to wolverine habitat. Given the extent of human disturbance relative to surrounding habitat, impacts on wolverines from the combined action alternatives would be minor. Although some individual wolverines could be displaced from suitable habitat as a result of the combined action alternatives, impacts on the wolverine population in the analysis area would be minimal due to the extent of available habitat.

Cumulative Effects

Past actions, particularly timber harvest, road construction, and fire-suppression activities, have altered the old growth ecosystems in the analysis area, resulting in a reduction in early and late succession habitats; conditions favoring shade-tolerant, fire-intolerant species; loss of large snags and down wood; increases in tree density; and a shift to a largely mid-seral structural stage (USDA Forest Service 2003b). Continuing development of private lands, including timber harvest, home construction, and land clearing would contribute to losses of wolverine habitat in the analysis area. Impacts to wolverine on private and state lands would probably be minimal because it is likely that wolverine habitat in these areas is of marginal quality.

Alternative 1A would not have cumulative impacts on the wolverine. Surface impacts from other reasonably foreseeable actions and the combined action alternatives in the analysis area would be minimal. Mineral exploration has occurred and would continue to occur throughout the Cabinet Mountains, cumulatively displacing wolverines from suitable habitat or reducing their ability to effectively use the available habitat. Human disturbance impacts to wolverines from the combined action alternatives would be compounded when impacts from other reasonably foreseeable actions, particularly the Wayup Mine/Fourth of July Road Access Project and the Bear Lakes Access Project are taken into account. Human disturbance effects would be greatest for activities that occur during the denning period (December 1 to April 30).

Some of the disturbance associated with construction of the proposed project and other reasonably foreseeable actions, such as blasting and helicopter line stringing and construction, would be short-term. Noise generated by construction and blasting for the evaluation adits for the Rock Creek Project would occur sporadically for several weeks. Underground blasting would be considered after the adit reaches a depth of about 500 feet at the Rock Creek site, based on experience at the Troy Mine adit. If blasting and other construction activities occurred concurrently for the Rock Creek and Montanore projects, cumulative noise disturbance could result in habitat displacement and increased stress levels for wolverines.

Other cumulative effects from the combined action alternatives include an increased risk of wolverine mortality from trapping due to increased access into wolverine denning habitat. Cumulative impacts could be offset by habitat acquisitions and road access changes associated with grizzly bear mitigation for the Montanore Project and other reasonably foreseeable actions. Some cumulative displacement effects would be offset by access changes planned as mitigation for the Montanore, Wayup Mine/Fourth of July Road Access, and the Bear Lakes Access projects.

3.24.4.9.4 Regulatory/Forest Plan Consistency

KFP

The KNF is directed to "identify, protect, and manage" habitat for sensitive species in order to assist in maintaining viable populations. The KFP contains the following goals and direction for sensitive species: "determine the status of sensitive species and provide for their environmental needs as necessary to prevent them from becoming threatened or endangered" (KFP Vol. 1, II-1 #6). All alternatives would meet this KFP direction for the wolverine.

National Forest Management Act

KFP direction is to "maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,… in sufficient quality and quantity to maintain viable populations" (KFP Vol. 1, II-1 #7). All combined action alternatives could impact individual

wolverines and/or their habitat, but would not contribute to a trend toward federal listing or loss of species viability for the fisher. This determination is based on: 1) of the action alternatives, only Alternative E would have physical impacts to wolverine denning habitat, which would be negligible (2 acres); 2) transmission line and human disturbance effects would be minimal and largely short-term; 3) impacts of blasting for the mine alternatives would be short-term; and 4) long-term human disturbance effects during project operations would occur on a relatively small proportion of total denning habitat in the analysis area.

3.24.4.10 Irreversible and Irretrievable Commitments

No other irreversible commitment of resources related to Forest sensitive species would occur for any of the alternatives.

All of the combined action alternatives would result in physical impacts to wetlands, riparian, old growth, general forest, and snag habitat important to forest sensitive species. Disturbance to sensitive species due to human disturbance, disruption of movement patterns, and habitat fragmentation could also occur as a result of the combined action alternatives. These impacts would be long-term and would be an irretrievable commitment of resources.

3.24.4.11 Short-term Uses and Long-term Productivity

The transmission line alternatives would result in short-term direct impacts to habitat important to sensitive species in areas where there would be limited vegetation clearing due to topography, span length, and other factors. All of the action alternatives would result in long-term physical impacts to sensitive species habitat and long-term impacts due to human disturbance, disruption of movement patterns, and habitat fragmentation. If reclamation were successful and successional processes were allowed to take place, areas of disturbed habitat could potentially be restored to suitable sensitive species habitat after a considerable length of time. As described in section 3.21, *Vegetation*, the action alternatives would result in long-term losses of habitat for old growth-dependent sensitive species in the Crazy PSU.

3.24.4.12 Unavoidable Adverse Environmental Effects

All action alternatives would result in unavoidable long-term losses or degradation of sensitive species habitat and disturbance of individuals. With implementation of water quality standards, Wetland Mitigation Plans (sections 2.4.6.1, *Wetland Mitigation Plan* for Alternative 2 and section 2.5.7.1, *Wetland Mitigation* for Alternatives 3 and 4)and the Environmental Specifications (Appendix D), Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*), and mitigation measures such as compensatory wetlands creation, road access changes, and habitat acquisition, these effects would be minimized.

3.24.5 Threatened, Endangered, and Proposed Species

3.24.5.1 Regulatory Framework

Section 3.6, *Aquatic Life and Fisheries* discusses the regulatory framework for federally listed threatened or endangered species. The MFSA directs the DEQ to approve a transmission line if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impacts, considering the state of available technology and the nature and economics of the various alternatives. An assessment of effects on federally listed threatened and endangered species is part of the transmission line certification process.

A current species list for the KNF was obtained from the USFWS website on June 6, 2008 (http://montanafieldoffice.fws.gov). The USFWS concurred with potential listed species distribution maps and resulting consultation areas for the KNF in 2001 (USFWS 2001). The status of federally listed threatened, endangered, and candidate wildlife species in the influence area of the proposed Montanore Project is shown in Table 190.

Table 190. Federally Listed Threatened, Endangered, and Candidate Species Potentially Affected by the Montanore Project.

Species	ESA Status	Status in Analysis Area	Comments*
Gray Wolf (*Canis lupus)*	Threatened	Known to occur	Inside Recovery Zone
Grizzly Bear (*Ursus arctos*)	Threatened	Known to occur	Inside Recovery Zone
Canada Lynx (*Lynx canadensis*)	Threatened	Known to occur	Inside Recovery Zone

*USFWS analysis area is inside Recovery Zone or reoccurring use area.

The USFWS removed the gray wolf from the list of threatened and endangered species on March 28, 2008. On July 18, 2008, the U.S. District Court for the District of Montana Missoula Division reinstated ESA protections for the northern Rocky Mountain gray wolf.

3.24.5.2 Gray Wolf

3.24.5.2.1 Analysis Area and Methods

Strategies to protect and recover wolf populations in Montana are outlined in the Northern Rocky Mountain Wolf Recovery Plan (USFWS 1987). The Montana Gray Wolf Conservation and Management Plan Final EIS (FWP 2003) specifies strategies to protect and manage wolf populations in Montana once they are recovered. The Northern Rocky Mountain Wolf Recovery Plan and the Montana Gray Wolf Conservation and Management Plan also provide descriptions of wolf ecology, biology, and habitat (USFWS 1987; FWP 2003). The KNF is within the Northwest Montana Recovery Area, one of three wolf recovery areas identified for the Northern Rocky Mountain wolf population (USFWS *et al.* 2004). Information for this recovery area is provided by the Rocky Mountain Wolf Recovery 2007 Annual Report (USFWS *et al.* 2008) and is incorporated herein by reference. Wolf occurrence data come from recent District wildlife observation records, forest historical data (NRIS FAUNA), other agencies (USFWS, FWP), and Wolf and Wildlife Studies, a private organization.

The analysis area for direct, indirect, and cumulative impacts to wolves and their habitat in the KNF are the Crazy and Silverfish PSUs. To evaluate potential direct, indirect, and cumulative impacts of the transmission line on gray wolves, the analysis area also includes all non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments.

The impacts analysis includes an evaluation of the potential benefits to wolves from mitigation measures. Mitigation measures incorporated into MMC's or the agencies' alternatives include access changes, land acquisition, prohibiting employees from carrying firearms, removing road-killed big game animals, busing employees to the work site, and monitoring road-killed animals along mine access roads to determine if improved access resulted in increased wildlife mortality, and the funding of two grizzly bear specialists and one law enforcement position.

Measurement indicators for evaluating effects of the alternatives on the gray wolf are based on the following key habitat components described in the Wolf Recovery Plan (USFWS 1987): year-round prey base, suitable denning and rendezvous sites, and sufficient space with minimal exposure to humans. The rationale for basing the impacts evaluation on these components and the indicators of effects are described in the following paragraphs.

Sufficient, Year-Round Prey Base

The condition of the prey base for the gray wolf is evaluated based on KFP management standards and objectives for white-tailed deer and elk. Effects of the alternatives on white-tailed deer and elk are described in section 3.24.3, *Management Indicator Species*.

Suitable Denning and Rendezvous Sites

Gray wolf den sites are generally greater than 1 mile from open roads and 1 to 2 miles from campsites (USFWS 1987). These sites are normally on southerly aspects, on moderate slopes, within 400 yards of surface water, and at an elevation overlooking surrounding low-lying areas. Sensitivity to disturbance at den sites and subsequent abandonment varies greatly among individual wolves (Thiel *et al.* 1998; Claar *et al.* 1999). Rendezvous sites (resting and gathering areas) are usually complexes of meadows and adjacent timber, with surface water nearby (USFWS 1987). They tend to be situated away from human activity and on drier sites that are slightly elevated above riparian areas (ibid.). FWP encourages land management agencies to consider the locations of wolf den and rendezvous sites in their planning activities to maintain the habitat integrity of these sites (Sime 2002). Den and rendezvous sites can also be protected by enacting timing restrictions on proposed activities within the den/rendezvous site areas. These restrictions would limit operating periods to the fall or winter seasons when these sites are unoccupied.

Sufficient Space with Minimal Exposure to Humans

Providing sufficient space with minimal exposure to humans can reduce the risk of human-caused mortality to wolves. Human disturbance and accessibility of wolf habitats (*i.e.*, road densities) are the principal factors limiting wolf recovery in most areas (Leirfallom 1970; USFWS 1978, 1987 all in Frederick 1991; Thiel 1978). These components can be generally measured by maintaining ORD standards required by the KFP as well as maintaining any security habitat recommended in the big game habitat recommendations.

MMC's proposed Alternatives 2 and B include an access change in NFS road #4724 from April 1 to June 30 and the yearlong access change in a segment of NFS road #4784 to mitigate for impacts to grizzly bears. NFS road #4784 is proposed for an access change by the Rock Creek Project, and is no longer available for Montanore Mine mitigation. The agencies' alternatives would include yearlong access changes, through the installation of barriers or gates, for several roads to mitigate for the loss of big game security and impacts to grizzly bear. Additional road access changes also would occur on land acquired as part of the mitigation plans proposed by MMC and the agencies. These road access changes would reduce potential exposure of wolves to humans.

3.24.5.2.2 Affected Environment

Distribution

At the end of 2007, there were 73 wolf packs in Montana, with 39 meeting breeding pair criteria. These packs contained a minimum estimate of 422 wolves (USFWS *et al.* 2008). The Montana

portion of the Northwest Recovery Area supported 31 of those packs (11 were breeding packs), consisting of 167 wolves. This area includes the KNF. There are currently 10 packs (5 breeding packs) using the KNF in all or part of their territories. These packs had 44 wolves at the end of 2007 (ibid.). There was one known mortality in the KNF packs in 2007.

The Fishtrap pack is the only known wolf pack potentially affected by the Montanore Project. The Fishtrap pack territory is located in and around the Thompson River, McGinnes Creek, and Fishtrap Creek drainages (USFWS *et al.* 2008), and includes portions of the Silverfish and McElk PSUs in an area in the southeast corner of the Libby Ranger District territory (McGinnis Meadows and East Fisher Creek). Since the pack was first documented in 2000, there have been five known depredations on livestock attributed to this pack, and three known wolf mortalities, including natural and human-caused mortalities (USFWS *et al.* 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008). No known mortalities occurred in the Fishtrap pack in 2007. Currently, the pack includes seven wolves and produced at least three pups in 2007. Three pack members are radio-collared. One radio-collared female wolf has left the Fishtrap pack and has joined the Mineral Mountain pack northwest of St. Regis (USFWS *et al.* 2008).

Seasonal movements of the Fishtrap pack vary from year-to-year. During the fall of 2002 and winter of 2003, the Swamp Creek corridor was used by the Fishtrap pack to travel across the Cabinet Mountains. Since that time, wolves have not been observed using this travel corridor (Laudon, pers. comm. 2008). In 2005 and 2006, the Fishtrap pack activity shifted to the southeast, perhaps in response to a new pack that appears to be using the Silver Butte Fisher River area (Mallonnee, pers. comm. 2006).

Tracks and other signs of one to two individual wolves have been consistently observed in the Libby, Midas, Poorman, Ramsey, Bear, and Big Cherry creek drainages since 2004. Wolf sign has also been observed in the West Fisher Creek, Miller Creek, and Swamp Creek drainages, and west of Howard Lake and north of Horse Mountain. In 2004, howls of 4 to 5 individual wolves were heard near Midas Point by two FWP biologists camped at Howard Lake. These observations suggest that at least two wolves use portions of the analysis area on a regular basis. No wolf packs or den sites have been confirmed in this general area (Laudon, pers. comm. 2008).

Prey Base

Abundant winter range and summer range used primarily by white-tailed deer, moose, and elk occurs in the analysis area. Populations of these three species combined provide a good year-round prey base for wolves. Existing habitat conditions for these species are described in section 3.24.3, *Management Indicator Species*.

Den and Rendezvous Sites

Wolf den and rendezvous sites are monitored annually. There are no known established den sites or rendezvous sites within either the Silverfish or Crazy PSU. At least one known den site and three documented rendezvous sites are located near McGinnis Meadows, about 6 miles south of U.S. 2 as it turns eastward toward Kalispell.

Sufficient Space with Minimal Exposure to Humans

The western half of the Crazy and Silverfish PSUs is dominated by the CMW and Inventoried Roadless Area (IRAs), which provide habitat for wolves and their prey base where exposure to humans is minimal. Most of the Crazy PSU is within Bear Management Unit (BMU) 5, which currently meets grizzly bear standards and objectives for core habitat, habitat effectiveness, and

linear ORD. Meeting grizzly bear standards also helps provide sufficient space for wolves with reduced exposure to humans. Most of the Silverfish PSU occurs within BMU 6, where grizzly bear standards and objectives for core habitat and habitat effectiveness are not met, but where linear ORD standards are met. No human-caused wolf mortalities have been documented for the Crazy or Silverfish PSU.

Private and State Land

Private and state land in the analysis area provides habitat for wolf prey species such as deer and elk, but this land has more roads that could provide human access to potential wolf habitat than National Forest System lands. Although private lands in the analysis area may receive some use by transient wolves, only the periphery of the Fishtrap pack territory extends to the extreme southern portion of private land in the analysis area.

3.24.5.2.3 Environmental Consequences

Alternative 1 – No Mine

Alternative 1 would not affect the gray wolf and would not change existing conditions for prey base, denning and rendezvous sites, or space with minimal exposure to humans.

Alternative 2 – MMC's Proposed Mine

None of the developments or activities associated with Alternative 2 would occur in the Silverfish PSU; Alternative 2 would not impact the gray wolf in the Silverfish PSU.

Prey Base

In Alternative 2, current populations of white-tailed deer, the MIS for general forest species in the Crazy PSU, would likely be maintained, and would continue to provide a good year-round prey base for wolves. Existing habitat conditions for these species are described in section 3.24.3, *Management Indicator Species*.

Den and Rendezvous Sites

No known den or rendezvous sites would be affected by Alternative 2.

Sufficient Space with Minimal Exposure to Humans

Alternative 2 would increase linear road density in the Crazy PSU, resulting in increased potential for human disturbance and an increased risk of human-caused wolf mortality. Linear ORD resulting from Alternative 2 construction would increase, and would be worse than the KFP standard. Alternative 2 would include snowplowing Bear Creek Road (NFS road #278) and Libby Creek Road (NFS road #231) during the evaluation program and while the Bear Creek Road is reconstructed, allowing poachers easy winter access to potential wolf habitat. Increased traffic could result in more wolves being killed by vehicles, although traffic increases are anticipated to be minimal (see section 3.20, *Transportation*). The Fishtrap pack does not occupy this area and would not likely be affected by Alternative 2. High road densities, increased human access, and disturbance from mine activities could impact other wolves using the Crazy PSU. Impacts to wolf habitat would be at least somewhat reduced through MMC's proposed land acquisition program. Acquired parcels would be managed for grizzly bear use in perpetuity, and could contribute additional wolf habitat where roads could be gated or barriered.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

None of the developments or activities associated with Alternative 3 would occur in the Silverfish PSU; Alternative 3 would not impact the gray wolf in the Silverfish PSU.

Alternative 3 would increase road densities in the Crazy PSU, but not as much as Alternative 2 due to road access changes (installation of gates or barriers and public access restrictions) included in the Wildlife Mitigation Plan (see section 2.5.7.3, *Wildlife Mitigation*) for Alternative 3. Increased road density could result in increased potential for human disturbance and an increased risk of human-caused wolf mortality. Alternative 3 would include snowplowing Bear Creek Road (NFS road #278) and Libby Creek Road (NFS road #231) during the evaluation program and while the Bear Creek Road is reconstructed, allowing poachers easy winter access to potential wolf habitat. Increased traffic could result in more wolves being killed by vehicles, although traffic increases are anticipated to be minimal (see section 3.20, *Transportation*). The Fishtrap pack does not occupy this area and would not likely be affected by Alternative 3. High road densities, increased human access, and disturbance from mine activities could impact other wolves using the Crazy PSU. Impacts to wolf habitat would be at least somewhat reduced through the agencies' land acquisition program, and would likely be more effective than MMC's proposed land acquisition program because more land would be protected. Acquired parcels would be managed for grizzly bear use in perpetuity, and could contribute additional wolf habitat where roads could be closed.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

None of the developments or activities associated with Alternative 4 would occur in the Silverfish PSU; Alternative 4 would not impact the gray wolf in the Silverfish PSU. Impacts of Alternative 4 on the wolf would be the same as Alternative 3.

Alternative A – No Transmission Line

Alternative A would not affect the gray wolf and would not change existing conditions for prey base, denning and rendezvous sites, or space with minimal exposure to humans.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Prey Base

In Alternative B, current populations of elk and white-tailed deer would likely be maintained, and would continue to provide a good year-round prey base for wolves. Existing habitat conditions and the effects of Alternative B on these species are described in section 3.24.3, *Management Indicator Species*.

Den and Rendezvous Sites

No known gray wolf den or rendezvous sites would be affected by Alternative B.

Sufficient Space with Minimal Exposure to Humans

During transmission line construction, Alternative B would increase road densities in the analysis area. Open road densities on National Forest System land would return to existing densities during transmission line operations and after reclamation. Although new roads on National Forest System land would be revegetated after transmission line construction, the roads would allow increased pedestrian access to potential wolf habitat, resulting in increased potential for human

disturbance and an increased risk of human-caused wolf mortality from poaching. Alternative B could result in an increased risk of human-caused mortality during transmission line construction due to increased traffic, although traffic increases are anticipated to be minimal and short-term (see section 3.20, *Transportation*). In Alternative B, helicopter line stringing, which would last about 10 days, could temporarily displace wolves from the transmission line corridor and surrounding habitat. Similar effects could occur from other transmission line construction activities associated in areas where helicopters were not used, and would be more extensive for Alternative B than the agencies' alternatives. Except for annual inspection and infrequent maintenance operations, helicopter use and other transmission line construction activities would cease after transmission line construction until decommissioning. Helicopter use and other activities could cause similar displacement during line decommissioning. Only the outer edge of the Fishtrap pack territory extends to the extreme southeast portion of the analysis area and the Fishtrap pack would not likely be affected by Alternative B. High road densities and transmission line construction activities could have short-term effects on other wolves using the analysis area. Impacts to wolf habitat would be somewhat reduced through MMC's proposed land acquisition program. Acquired parcels would be managed for grizzly bear use in perpetuity, and could contribute additional wolf habitat where roads could be closed. Overall, Alternative B would have a minimal effect on the gray wolf.

Alternative C – Modified North Miller Creek Transmission Line Alternative

Prey Base

In Alternative C, current populations of elk and white-tailed deer would likely be maintained, and would continue to provide a good year-round prey base for wolves. Existing habitat conditions and the effects of Alternative C on these species are described in section 3.24.3, *Management Indicator Species*.

Den and Rendezvous Sites

No known den or rendezvous sites would be affected by Alternative C.

Sufficient Space with Minimal Exposure to Humans

Alternative C would increase road densities in the Crazy PSU, but not as much as Alternative B, due to road access changes included in the Wildlife Mitigation Plan (section 2.5.7.3, *Wildlife Mitigation*) for agencies' alternatives. Open road densities on National Forest System land would return to existing densities during transmission line operations and after reclamation. Although new roads on National Forest System land would be revegetated after transmission line construction, they would allow increased pedestrian access to potential wolf habitat, resulting in increased potential for human disturbance and an increased risk of human-caused wolf mortality from poaching. Alternative C could result in an increased risk of human-caused mortality during transmission line construction due to increased traffic, although traffic increases are anticipated to be minimal and short-term (see section 3.20, *Transportation*). In Alternative C, helicopters would be used for stringing the entire transmission line and in some segments for vegetation clearing and structure placement, extending the duration of disturbance by about 2 months. Vegetation clearing and structure placement where helicopters were not used could contribute to short-term displacement of wolves. In Alternative C, except for annual inspection and infrequent maintenance operations, helicopter and other transmission line construction activities would cease after transmission line construction until decommissioning, similar to Alternative B. Helicopter use and other activities could cause similar displacement during line decommissioning.

Only the outer edge of the Fishtrap pack territory extends to the extreme southeast portion of the analysis area, and the Fishtrap pack would not likely be affected by Alternative C. High road densities and transmission line construction activities could have short-term effects on other wolves using the analysis area. Impacts to wolf habitat would be at least somewhat reduced through the agencies' land acquisition program, and would likely be more effective than MMC's proposed land acquisition program because more land would be protected. Acquired parcels would be managed for grizzly bear use in perpetuity, and could contribute additional wolf habitat where roads could be closed. Overall, Alternative C would have a minimal effect on the gray wolf.

Alternative D – Miller Creek Transmission Line Alternative

The impacts of Alternative D on gray wolves would be the same as Alternative C.

Alternative E – West Fisher Creek Transmission Line Alternative

The impacts of Alternative E on gray wolves would be the same as Alternative D.

Combined Mine-Transmission Line Effects

None of the activities associated with the mine alternatives would occur in the Silverfish PSU; all impacts to wolves in the Silverfish PSU would be due to the transmission line.

Prey Base

In all combined mine-transmission line alternatives, current populations of white-tailed deer and elk, the MIS for general forest species in the Crazy and Silverfish PSUs, would likely be maintained, and would continue to provide a good year-round prey base for wolves. Existing habitat conditions for these species are described in detail section 3.24.3, *Management Indicator Species*.

Den and Rendezvous Sites

No known den or rendezvous sites would be affected by any of the combined mine-transmission line alternatives.

Sufficient Space with Minimal Exposure to Humans

All combined action alternatives would increase road densities in both the Crazy and Silverfish PSUs, resulting in increased potential for human disturbance and an increased risk of human-caused wolf mortality. High road densities and transmission line construction activities could have short-term effects on other wolves using the analysis area. Road densities would increase the most for Alternative 2B in the Crazy PSU (BMU 5), and would remain worse than existing road densities until after mine closure. All combined action alternatives would include snowplowing Bear Creek Road (NFS road #278) and Libby Creek Road (NFS road #231) during the evaluation program and while the Bear Creek Road is reconstructed, allowing poachers easy winter access to potential wolf habitat. Increases in open road densities in the Silverfish PSU would be short-term, and would diminish after transmission line construction. Although new roads on National Forest System land would be revegetated after transmission line construction, they would allow increased pedestrian access to potential wolf habitat, resulting in increased potential for human disturbance and an increased risk of human-caused wolf mortality from poaching. Increased traffic could result in more wolves being killed by vehicles, although traffic increases are anticipated to be minimal in all combined action alternatives (see section 3.20, *Transportation*).

For all combined action alternatives, helicopter and other transmission line construction activities could temporarily displace wolves from the transmission line corridor and surrounding habitat. Disturbance from helicopter use and other transmission line construction activities are described for Alternatives B and C above. Only the outer edge of the Fishtrap pack territory extends to the extreme southeast portion of the analysis area, and the Fishtrap pack would not likely be affected by any of the combined action alternatives.

Impacts to wolf habitat could be reduced through MMC's or the agencies' land acquisition program. Acquired parcels would be managed for grizzly bear use in perpetuity, and could contribute additional wolf habitat where roads could be closed. The agencies' land acquisition program would likely be more effective than MMC's proposed land acquisition program because more land would be protected. For the combined agencies' alternatives, potential impacts to wolves also would be minimized through road access changes (installation of gates or barriers and public access restrictions) that would create security habitat for prey species and reduce motorized access of wolf habitat. For all action alternatives, potential impacts to wolves also would be reduced by prohibiting employees from carrying firearms and removing road-killed big game animals. For the combined agencies' alternatives, implementation of a transportation plan to reduce mine traffic, and monitoring road-killed animals also would reduce mortality risks for wolves. All action alternatives include the funding of two grizzly bear specialist positions and one law enforcement position. Although the objective of these positions would be focused on reducing mortality risk for grizzly bears, they would likely indirectly benefit wolves by increasing public awareness of issues related to threatened and endangered species in general, and improving enforcement of road access changes. Overall, all combined action alternatives would have a minimal effect on the gray wolf.

Cumulative Effects

Cumulative effects of the combined mine-transmission line alternatives in combination with other reasonably foreseeable actions are not likely to change big game populations that provide prey for wolves. While cumulative losses of both cover and forage habitat would occur, areas disturbed as a result of the combined action alternatives and other reasonably foreseeable actions could provide additional forage habitat after reclamation, thereby improving habitat conditions for big game. Current populations of white-tailed deer and elk, the MIS for general forest species in the Crazy and Silverfish PSUs, would likely be maintained and would continue to provide a good year-round prey base for wolves. Existing habitat conditions and effects of the alternatives on big game species are described in section 3.24.3, *Management Indicator Species*.

No known den or rendezvous sites would be affected by any of the combined mine-transmission line alternatives and none would contribute to cumulative effects on wolf denning or rendezvous sites.

Cumulative effects of the combined action alternatives, in combination with other reasonably foreseeable actions, on the Fishtrap pack would likely be minimal because the Fishtrap territory does not go beyond the extreme southeast portion of the analysis area. Cumulative increases in road densities from the combined action alternatives, in combination with other reasonably foreseeable actions, could impact other wolves using the analysis area. Helicopter use and other construction activities associated with the combined action alternatives could also contribute to cumulative impacts on wolves, although their effects would be temporary. Impacts to wolf habitat would be at least somewhat reduced through road access changes land acquisition programs associated with grizzly bear and big game mitigation for the combined action alternatives and

reasonably foreseeable actions, especially the Rock Creek Project. Acquired parcels would be managed for grizzly bear use in perpetuity, and could contribute additional wolf habitat where roads could be closed.

3.24.5.2.4 Regulatory/Forest Plan Consistency

KFP. All action alternatives would comply with KFP direction on threatened and endangered species that applies to the gray wolf (KFP Vol. 1, II-1 #5 and II-23) and its prey base (KFP Vol. 1, II-1 # 3 and #12, II-7, and II-22-23).

Endangered Species Act. For all alternatives, ESA compliance would be ensured through Section 7 consultation. The KNF will submit a BA to the USFWS that describes the potential effect on threatened and endangered species that may be present in the area. After review of the BA and consultation, the USFWS will issue a BO for the proposed Montanore Project.

Statement of Findings. Alternative 2B may affect, but is not likely to adversely affect, the gray wolf for the following reasons:

- Sufficient populations of elk, deer, and other prey species would continue to be maintained and would continue to provide a good year-round prey base for wolves.
- No known den or rendezvous sites would be affected by any of the combined mine-transmission line alternatives.
- Overall road densities would increase in the analysis area and near the mine facilities. These increases would last until after mine closure and reclamation. Potential impacts to the gray wolf from increased road densities would be reduced through MMC's land acquisition program associated with grizzly bear mitigation. Acquired parcels would be managed for grizzly bear use in perpetuity, and could improve wolf habitat where roads could be closed.
- Other measures included in Alternative 2B that could reduce potential mortality risks associated with increased road densities include prohibiting employees from carrying firearms; removing road-killed big game animals; and funding of two grizzly bear specialists and one law enforcement position, which would likely indirectly benefit wolves through improved enforcement of access changes and by increasing public awareness of issues related to threatened and endangered species in general.

All combined agencies' alternatives may affect, but are not likely to adversely affect, the gray wolf for the following reasons:

- Sufficient populations of elk, deer, and other prey species would continue to be maintained, and would continue to provide a good year-round prey base for wolves. For the agencies' alternatives, access changes associated with big game and grizzly bear mitigation would create security habitat for prey species.
- No known den or rendezvous sites would be affected by any of the combined mine-transmission line alternatives.
- Combined agencies' alternatives would result in short-term increases in overall road densities and disturbance from helicopter use and other activities in the analysis area during transmission line construction. During the operations phase, road densities would improve due to road access changes (installation of gates or barriers and public

access restrictions) associated with big game and grizzly bear mitigation, minimizing mortality risks for wolves.

- Impacts to the wolf would be reduced through the agencies' land acquisition program associated with grizzly bear mitigation. Acquired parcels would be managed for grizzly bear use in perpetuity, and could improve wolf habitat where roads could be closed.
- Other measures to reduce mortality risks are prohibiting employees from carrying firearms; removing road-killed big game animals; implementation of a transportation plan to reduce mine traffic; and funding two grizzly bear specialists and one law enforcement position, which would likely indirectly benefit wolves through improved enforcement of access changes and by increasing public awareness of issues related to threatened and endangered species in general.

3.24.5.3 Grizzly Bear

3.24.5.3.1 Analysis Area and Methods

Grizzly bear population ecology, biology, habitat description, and relationships identified by research are described in Kasworm and Manley (1988), USFWS (1993), Johnson (2003), Kasworm *et al.* (2007), MMC (2005), and USDA Forest Service (2005c); and are incorporated herein by reference. Grizzly bear occurrence data come from recent District wildlife observation records, KNF historical data (NRIS FAUNA), other agencies (USFWS, FWP), and Westech (2005a). KNF GIS data was used for core grizzly bear habitat, BMUs, roads, and grizzly bear outside the recovery zone (BORZ) reoccurring use polygons.

The proposed project is in the Cabinet-Yaak Ecosystem grizzly bear recovery zone (USFWS 1993). The analysis area for project impacts to individuals and their habitat are the BMUs in the recovery zone and the BORZ polygon (Wittinger *et al.* 2002) potentially affected by the Montanore Project. Specifically, the analysis area is the Snowshoe, St. Paul, and Wanless BMUs (BMUs 2, 5, and 6, respectively) and the Cabinet Face BORZ polygon, including private and state lands (Figure 90). The boundary for cumulative effects and making the effects determination is BMUs 2, 5, and 6 and the Cabinet Face BORZ polygon.

Current grizzly bear standards and objectives are established by the KFP; consultations since 1987, including the 1995 Amended Biological Opinion and Incidental Take Statement on the KFP (USFWS 1995); and the Selkirk/Cabinet-Yaak Grizzly Bear Areas Interim Access Management Rule Set from December 1, 1998 (IGBC 1998).

Research conducted by Wakkinen and Kasworm (1997) in the Selkirk and Cabinet-Yaak Ecosystems that examined the concepts of open motorized route density (OMRD), total motorized route density (TMRD), and core habitat is considered "best science" applicable to the Montanore Project. Johnson (2007a) supports this position.

Effects of the proposed project may be influenced by grizzly bear seasonal use of potentially affected habitats. Grizzly bear use seasons have been defined through grizzly bear research. Although there may be considerable variation between individuals, based on Kasworm *et al.* (2007) and Johnson *et al.* (2008), seasons are defined as:

- Denning: December 1 – March 31

- Spring: April 1 – June 15
- Summer: June 16 – September 15
- Fall: September 16 – November 30
- Non-denning season: same as active bear year
- Active bear year: April 1 – November 30 (Johnson *et al.* 2008)

MMC's proposed Alternatives 2 and B include an access change in NFS road #4724 from April 1 to June 30 and the yearlong access change in a segment of NFS road #4784 to mitigate for impacts to grizzly bears. NFS road #4784 is proposed for an access change by the Rock Creek Project, and is no longer available for Montanore Mine mitigation. The agencies' alternatives would include yearlong access changes through the installation of barriers or gates in several roads to mitigate for the loss of big game security and impacts to grizzly bear. These road access changes are taken into account in grizzly bear effects calculations. Additional road access changes also would occur on land acquired as part of the mitigation plans proposed by MMC and the agencies. Core, road density, and HE calculations do not take into account the effect of land acquisition programs proposed by MMC and the agencies described in the respective mitigation plans in sections 2.4.6.3, *Grizzly Bear Mitigation Plan* and 2.5.7.3, *Wildlife Mitigation*.

Analysis of Effects to Grizzly Bear Inside the Recovery Zone

The goal for grizzly bear management on the KNF is to provide sufficient quantity and quality of habitat to facilitate grizzly bear recovery. An integral part of the goal is to implement measures within the authority of the Forest Service to minimize human-caused grizzly bear mortalities. This goal is accomplished by achieving five objectives common to grizzly bear recovery as described by Harms (1990), and by a sixth objective specific to the KNF concerning acceptable incidental take (McMaster 1995). NFMA and ESA require the use of "best science" to complete environmental effects analyses. Johnson (2007a) supports research conducted by Wakkinen and Kasworm (1997) in the Selkirk and Cabinet-Yaak Ecosystems that examined the concepts of OMRD, TMRD, and core habitat as best science applicable to this area. Analyses used to evaluate whether or not objectives are being met are listed below each objective.

Objective 1: provide adequate space to meet the spatial requirements of a recovered grizzly bear population.

Percent habitat effectiveness. Habitat effectiveness (HE) is defined as the amount of secure grizzly bear habitat (habitat at least 0.25 mile from open roads, developments, and high levels of human activity during the active bear year) remaining within a BMU after affected areas and Management Situation (MS) 3 lands are subtracted from the total habitat in the BMU. MS 3 lands are areas of high human use where grizzly bear presence is possible but infrequent and where conflict minimization is a high priority management consideration. Grizzly bear presence and factors contributing to their presence will be actively discouraged.

In calculating HE, the extent of a zone of influence depends on the type of activity, as recommended in the Cumulative Effects Analysis Process (USDA Forest Service 1988a). HE is calculated for all lands within an affected BMU, regardless of ownership. HE should be maintained equal to or greater than 70 percent of the BMU.

Core Area. A core area or core habitat is an area of high-quality grizzly bear habitat within a BMU that is greater than or equal to 0.31 mile from any road (open or restricted), or motorized

trail open during the active bear season. Core habitat may contain restricted-access roads, but such roads must be effectively closed with devices, including but not limited to, earthen berms, barriers, or vegetative growth. Core is calculated by buffering roads, motorized trails, and high-use non-motorized trails on all lands, regardless of ownership, in a BMU (IGBC 1998). Best science indicates that at least 55 percent of a BMU should be core habitat (Wakkinen and Kasworm 1997). Federal agencies will work toward attaining a core area of at least 55 percent in the BMU and will allow no loss of core areas on federally-owned land within the BMU (IGBC 1998). New core habitat created to compensate for loss of previously existing core habitat by a project will: 1) be in place prior to conducting the activity; 2) be equal to or better in habitat quality (including seasonal components); 3) be at least equal in block size; and 4) kept in place through the entire period of the interim rule set.

Open motorized route density. OMRD is calculated for a BMU using moving window analysis. The moving window analysis is a technique for measuring road densities on a landscape using GIS. Results are displayed as a percent of the analysis area in relevant route density classes. OMRD is expressed as the percent of the entire BMU, regardless of ownership, with open road density greater than 1 mi/mi^2. Best science indicates that OMRD greater than 1 mi/mi^2 should not exceed 33 percent of a BMU (Wakkinen and Kasworm 1997). Federal agencies will allow no net increase in OMRD on federally-owned land within the BMU (IGBC 1998).

Total motorized route density. TMRD is calculated for a BMU using moving window analysis. TMRD is expressed as the percent of the entire BMU, regardless of ownership, with total route density greater than 2 mi/mi^2. Best science indicates that TMRD greater than 2 mi/mi^2 should not exceed 26 percent of a BMU (Wakkinen and Kasworm 1997). Federal agencies will allow no net increase in OMRD on federally-owned land within the BMU (IGBC 1998).

Linear open road density. Linear ORD is calculated for each BMU and should not exceed 0.75 mi/mi^2. Individual Active Bear Analysis Areas (BAAs) may exceed the standard for linear ORD if the BMU as a whole meets the standard; the BAA is where the activity is occurring; or the BAA has a higher ORD standard established as a result of prior consultation with the USFWS. Linear ORD is calculated for MS 1 lands only, regardless of ownership. MS 1 areas contain grizzly bear population centers and habitat components needed for the survival and recovery of the species or a segment of its population. MS 1 areas are managed for grizzly bear habitat maintenance, improvement, and minimization of grizzly bear-human conflict. Management decisions will favor the needs of the grizzly bear when grizzly habitat and other land use values compete.

Objective 2: Manage for an adequate distribution of bears across the ecosystem.

Opening size. Proposed actions in combination with existing unrecovered harvest units or natural openings should not create openings greater than 40 acres. When, for justified reasons, an opening exceeds 40 acres, no location in the opening should be greater than 600 feet from cover.

Movement corridors. Unharvested corridors greater than 600 feet in width should be maintained between proposed harvest units and existing harvest units and natural openings.

Seasonal components. Proposed activities should be scheduled to avoid spring habitats during the spring use period (April 1 to June 15). Activities in close proximity of known den sites should be avoided during the denning period (December 1 to March 31).

Road density and displacement (core) areas. Road density and displacement (core) areas are discussed in Objectives 1 and 6.

Objective 3: Manage for an acceptable level of mortality risk.

Most human-caused grizzly bear mortalities on the KNF are the result of interactions between bears and big game hunters (Kasworm and Manley 1988). Grizzly bear vulnerability to human-caused mortality is partially a function of habitat security. Mortality risk can be partially assessed by the use of habitat factors that maintain or enhance habitat security (Objectives 1, 2, and 6).

Attraction of grizzly bears to improperly stored food and garbage is identified by the Recovery Plan as one of the principal causes of grizzly bear mortality (USFWS 1993). Bears that lose their natural fear and avoidance of humans, usually as a result of food rewards, become habituated, and may become food-conditioned.

Objective 4: Maintain/improve habitat suitability with respect to bear food production.

Timber harvest and post-harvest treatments such as prescribed burning, when conducted within KFP standards, generally have a positive effect on the growth of forage plants important to bears. Riparian habitats are also generally considered valuable feeding sites.

Objective 5: Meet the management direction outlined in the Interagency Grizzly Bear Guidelines for Management Situation 1, 2, and 3.

Meeting Objectives 1 through 4 has been determined to meet the intent of the Interagency Grizzly Bear Guidelines for Objective 5 (Buterbaugh 1991).

Objective 6: Meet the interim management direction specified in the July 27, 1995 Forest Plan Incidental Take Statement (McMaster 1995) to avoid exceeding authorized incidental take levels.

Open road density. Manage the density of open roads within the KFP standard. See Objective 1 for details.

Open motorized trail density. Do not increase the existing density of open motorized trails in the affected BMU.

Total motorized route density. Manage all motorized access routes (open and restricted roads and motorized trails) in the affected BMU to avoid a net increase over the existing density. See Objective 1.

Existing core area size. Manage the amount of existing core area in the affected BMU to avoid a net decrease. See Objective 1.

Analysis of Effects to Grizzly Bear Outside the Recovery Zone

The USFWS has identified three factors falling under Forest Service jurisdiction that contribute to "take" (ESA Section 9) of grizzly bears that apply in BORZ polygons, as identified by Wittinger *et al.* (2002): 1) access management; 2) food attractants (human and livestock food storage and garbage); and 3) livestock presence. To reduce the potential for mortality and displacement of grizzly bears from occupied habitat in BORZ areas, KNF access management standards for BORZ areas were established based on the best science available (Johnson 2007b; Johnson 2007c). These standards are:

- The KNF will ensure no increases in linear open road (ORD) (*i.e.*, non-gated roads open to public use) densities on National Forest System lands in any individual area of grizzly bear occupancy, greater than existing conditions.
- The KNF will ensure no permanent increases in linear total road densities (TRD) on National Forest System lands greater than existing conditions. Temporary increases in linear total road densities are acceptable under the following conditions:
  - Newly constructed roads will be effectively gated and closed to public use.
  - Roads closed to meet the no net increase in linear total road densities will: 1) be closed immediately upon completion of activities requiring use of the road; 2) be effectively closed with a berm, guardrail, or other effective measure; and 3) put in a condition such that a need for motorized access for maintenance is not anticipated for at least 10 years.
  - Upon completion of a project, linear total road densities will return to pre-project densities.

The first 10.3 miles of NFS road #231 and first 4.7 miles of NFS road #278 are in the Cabinet Face BORZ polygon (Figure 90). Based on information from Johnson (2003), existing conditions for the Cabinet Face BORZ are 2.2 mi/mi^2 of linear ORD and 3.9 mi/mi^2 of linear TRD.

Impacts to grizzly bears on private and state land outside of the recovery zone from the transmission line alternatives were evaluated qualitatively, based on predicted changes in habitat quality, displacement effects during construction, operations, reclamation, changes in road densities, and potential for increased food attractants.

3.24.5.3.2 Affected Environment

Inside Recovery Zone

The grizzly bear population for the Cabinet-Yaak Ecosystem is currently estimated at 40 to 45 bears, including at least 15 bears in the Cabinet portion of the Cabinet-Yaak Ecosystem, with a 94 percent probability of a downward population trend (Kasworm *et al.* 2007). Because of the age structure and small size of the population, augmentation of the Cabinet grizzly bear population began in 1990. Four subadult female bears captured in southeast British Columbia were moved to the Cabinet Mountains for release from 1990 to 1994. None of the transplanted bears were wearing a functioning radio collar by the end of 1995. Two grizzly bears (adult female and subadult female) were moved from the North Fork Flathead River to the western Cabinet Mountains in 2005 and 2006. In the summer of 2008, two additional subadult female grizzly bears were moved from the Whitefish Range and Swan River to the eastern Cabinet Mountains. The bears translocated in 2008 were killed in October 2008 near Noxon, MT, one from a train strike and the other from an illegal shooting (Kasworm 2008).

Based on results of a 5-year radio-telemetry study conducted by FWP from 1983 to 1987, home ranges of three collared bears overlapped around the upper portions of Bear Creek, Cable Creek, Poorman Creek, and Ramsey Creek within BMU 5 (Kasworm and Manley 1988). Home ranges extended laterally from this area throughout BMUs 5 and 6. A large male grizzly captured in the Bull River drainage in 2005 spent considerable time in the upper Libby Creek drainage during the fall of 2005 and also the spring of 2006. This bear was located on numerous occasions less than 1 mile east of the Libby Adit Site. Bear activity in the Snowshoe, St. Paul, and Wanless BMUs is

summarized in Table 191. Grizzly bear habitat and habitat characteristics in the Snowshoe, St. Paul, and Wanless BMUs are listed in Table 192 and shown on Figure 90. All habitat standards and goals are met for BMUs 2 and 5. The standard for linear ORD is met in BMU 6; the standards and goals for the other habitat parameters are not met in this BMU.

Table 191. Credible Grizzly Bear Sightings, Credible Female with Young Sightings, and Known Human-Caused Mortality by BMU in 2004.

BMU #	Credible Grizzly Bear Sightings	Unduplicated Sightings of Females with Cubs	Sightings of Females with Yearlings or 2-Year Olds	Human-Caused Mortality
Snowshoe (2)	3	0	1	0
St. Paul (5)	5	1	3	0
Wanless (6)	4	0	2	0

Source: Kasworm *et al.* 2005.

Table 192. Existing Grizzly Bear Habitat Conditions by BMU.

BMU #	Percent Core Habitat	Percent OMRD >1 mi/mi^2	Percent TMRD >2 mi/mi^2	Linear ORD mi/mi^2	Percent Habitat Effectiveness
Snowshoe (2)	76 (≥55)	20 (no net increase)	14 (no net increase)	0.30 (≤0.75)	79 (≥70)
St. Paul (5)	60 (≥55)	27 (no net increase)	23 (no net increase)	0.52 (≤0.75)	72 (≥70)
Wanless (6)	**54** (≥55)	35 (no net increase)	33 (no net increase)	0.63 (≤0.75)	**66** (≥70)

Values in parentheses represent KFP standards or goals and measures developed to meet KFP objectives and comply with the ESA based on consultations since 1987; USFWS (1995); IGBC (1998); and best science applicable to the Montanore Project (Wakkinen and Kasworm 1997).
Bolded values do not meet standards or goals.
BMU = Bear Management Unit.
ORD = open road density.
OMRD = open motorized route density.
TMRD = total motorized route density.
Source: USDA Forest Service 2007e.

Existing conditions for the BAAs within BMUs 2, 5, and 6 are available in the KNF project record. Activities associated with the mine alternatives would occur in BAAs 555 and 556 (BMU 5), while activities associated with the transmission line alternatives would occur in BAAs 556 (BMU 5), 566, and 567 (BMU 6). Linear ORD currently exceeds 0.75 mi/mi^2 within BAAs 555 and 556 (BMU 5), and BAA 566 (BMU 6). Reducing ORDs to 0.75 mi./mi^2 within BAAs 555, 556, and 566 would require an access change in main National Forest System loop roads or roads where status and management jurisdiction (Forest Service vs. County) is currently in question.

Several openings in forest cover greater than 40 acres occur in BMUs 2, 5, and 6, but no part of these openings is farther than 600 feet from forest cover. Several unharvested corridors greater than 600 feet occur between existing unrecovered harvest units.

Excellent year-round habitat components are present in BMUs 5 and 6, with documented use by grizzly bears (Kasworm and Manley 1988). Grizzly bear den sites in the Cabinet Mountains are generally in remote areas above 5,000 feet that have well-developed soils for excavation and adequate snow accumulation. The two closest known grizzly bear dens from the general Montanore Project area were found about 3 miles to the west in the upper Bear Creek and Cable Creek drainages. Spring grizzly bear habitat comprises about 63 percent of BMU 2, 72 percent of BMU 5, and 70 percent of BMU 6.

Human-caused mortality has been identified as one of the main factors in the demise of the grizzly bear in the Cabinet-Yaak Ecosystem (Kasworm and Manley 1988). At least 28 known human-caused mortalities were documented within 10 miles of the Cabinet-Yaak Recovery Zone (including Canada) from 1982 to 2006 (Kasworm et. al. 2007). Thirteen of those mortalities have occurred from 2001 to 2006, including eight females.

During the 1980s, most documented grizzly mortalities in the Cabinet-Yaak Ecosystem were the result of interactions between bears and big game hunters (Kasworm and Their 1990). The relatively small size of the Cabinet Mountains portion of the ecosystem, coupled with high accessibility, creates a strong potential for the illegal shooting of grizzly bears (Kasworm and Knick 1989). In this regard, increased law enforcement along with better public education and awareness is of vital importance to grizzly recovery in the Cabinet-Yaak Ecosystem.

The maximum human-caused mortality level that can be sustained by a grizzly bear population before resulting in population decline is 6 percent, when no more than 30 percent of mortalities are female bears (Harris 1984). The goal for the Cabinet-Yaak Ecosystem is less than 4 percent human-caused mortality, with no more than 30 percent of total mortality consisting of female bears (USFWS 1993). Based on a minimum population estimate of 40 individuals (Kasworm *et al.* 2007), 4 percent mortality of the grizzly bear population in the Cabinet-Yaak Ecosystem would be equivalent to 0.7 bears per year (ibid.). Thirty percent female mortality would be equivalent to 0.2 females per year, or one female mortality every 5 years. Average annual human-caused mortality for 2001–2006 was 1.7 for all bears and 1.3 for females (ibid.). The Grizzly Bear Recovery Plan established a human-caused mortality goal of zero for this recovery zone because grizzly bear numbers are so small in this ecosystem (USFWS 1993).

Outside Recovery Zone

In 2005, the Cabinet Face BORZ polygon was not known to be occupied by any females with young, and no known mortality was reported for the polygon. Current linear ORD for the Cabinet Face BORZ is 2.2 mi/mi^2, while the TMRD is 3.9 mi/mi^2. Neither livestock nor food attractants are present in the Cabinet Face BORZ polygon on National Forest System lands. Lincoln County collection dumpsters located adjacent to U.S. 2 at the eastern edge of the BORZ polygon are a known attractant site. Black bears in particular have been a problem at this site.

With exception of small portions in the West Fisher Creek and Miller Creek drainages, which are in BMU 6, private and state land in the alternative transmission line corridors occurs entirely in the Cabinet Face BORZ polygon. Road densities are generally high on private and state land within the alternative transmission line corridors. Most previously harvested areas have well-

established conifer regeneration primarily dominated by dry, ponderosa pine/Douglas-fir communities, as described in section 3.21, *Vegetation*. Small areas of cottonwood or spruce/fir riparian providing potential feeding sites for grizzly bears occur in the Fisher River, West Fisher Creek, and Hunter Creek riparian corridors.

As described for elk in section 3.24.3, *Management Indicator Species*, a wildlife linkage zone has been identified in the Fisher River Valley between the Barren Peak and Teeters Peak areas to the west of U.S. 2, and the Kenelty Mountain and Fritz Mountain areas to the east of U.S. 2 (see KNF project records). U.S. 2 in the Fisher River Valley between Raven and Brulee creeks is a crossing area for grizzly bears moving between the Cabinet Mountains and the Salish Mountains (Brown, pers. comm. 2008).

3.24.5.3.3 Environmental Consequences

The effects of the combined mine-transmission line alternatives are shown in Table 195. Road access changes associated with mitigation were determined for the combined mine-transmission line alternatives. It is not possible to attribute these road access changes to individual mine and transmission line alternatives independent of one another. Thus, the evaluation of individual transmission line alternative impacts to grizzly bear is based on direct impacts and disturbance to bear habitat and access changes during transmission line construction, as shown in Table 193 and Table 194. Transmission line impacts to core, road densities, and HE may be inferred from impact calculations for the combined mine-transmission line alternatives. For example, for BMU 5 because core and ORD are similar for combined alternatives associated with Alternative 3 and combined alternatives associated with Alternative 4, the effects of the proposed project appear to be due primarily to the mine alternatives. In BMU 6, core and ORD would be primarily affected by the transmission line alternatives, and effects are similar for the combined alternatives associated with Alternatives C, D, and E.

Alternative A – No Transmission Line

Alternative A would not change existing conditions for the grizzly bear inside or outside the recovery zone.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Inside Recovery Zone

Alternative B would not affect the grizzly bear in BMU 2.

Physical habitat disturbance. Alternative B would result in the clearing of about 167 acres within BMUs 5 and 6, and the physical removal of about 40 acres of potential grizzly bear habitat as a result of new roads constructed (Table 193). In Alternative B, the new road prism would remain during transmission line operations, but roads opened or constructed for transmission line access would be gated or barriered on National Forest System land after transmission line construction. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction. All disturbed areas, such as access roads, pulling and tensioning sites, and transmission line clearing areas, would be seeded with grass and shrub species after transmission line construction. Areas where trees were trimmed, but otherwise not disturbed, would be allowed to establish naturally as grassland or shrubland. If revegetation were successful, disturbed areas would provide additional forage habitat as forage species become established.

Table 193. Physical and Displacement Impacts of Transmission Line Alternatives in the Analysis Area.

Measurement Criteria	[A] No Transmission Line/Existing Conditions	[B] MMC's Proposed Transmission Line (North Miller Creek Alternative)	[C] Modified North Miller Creek Transmission Line Alternative	[D] Miller Creek Transmission Line Alternative	[E] West Fisher Creek Transmission Line Alternative
Clearing on National Forest System Land in BMUs 5 and 6 (acres)[1]	0	167	156	163	192
Clearing on Private or State Land in the Cabinet Face BORZ (acres)[1]	0	132	170	182	163
Bear Habitat Physically Removed (acres)[2]	0	40	13	14	14
Temporary Displacement in Recovery Zone (acres)[3, 4]	0	7,164	5,254	6,856	10,980
Temporary Displacement Outside of Recovery Zone (acres)[3, 4]	0	7,737	7,328	6,720	5,521
Total Temporary Displacement (acres)[3, 4]	0	14,901	12,582	13,576	16,501

BORZ = grizzly bear outside the recovery zone reoccurring use polygon.

[1] Potential habitat in transmission line corridor, including the Sedlak Park Substation and loop line, may be altered but would remain useable habitat.

[2] Includes impacts of new roads constructed for transmission line at 4 acres per mile and Sedlak Park Substation.

[3] The effects of activities potentially resulting in the displacement of bears from their habitat is calculated by applying influence zones for point source and linear disturbances established in Christensen and Madel (1982) and USDA Forest Service (1988a). Displacement effects were calculated by applying a 1-mile buffer on each side of helicopter flight path. Displacement effects are shown for the worst-case scenario. Area of displacement effect includes areas where other activities may currently be contributing to displacement of grizzly bears. Displacement effects from new and open roads, clearing, and construction of structures associated with the transmission line alternatives are entirely encompassed by the helicopter displacement buffer. Area of displacement due to helicopter use does not include areas within influence zone of proposed motorized point 24-hour activity or existing roads that would be used for the Montanore Project.

[4] In Alternative B, the use of helicopters during line construction would be at the discretion of MMC. The agencies assumed that helicopters would not be used for logging or structure placement in Alternative B. Helicopter use was assumed for line stringing and maintenance and annual inspections only.

Table 194. Miles of Open, Closed, and New Access Roads Required for Transmission Line Construction.

Road Type	Alternative B – North Miller Creek	Alternative C – Modified North Miller Creek	Alternative D – Miller Creek	Alternative E – West Fisher Creek
Open Road				
Within a BMU (miles)	8.5	6.5	4.4	3.3
Within Cabinet Face BORZ (Bears Outside Recovery Zone) (miles)	11.8	16.2	15.3	8.7
Subtotal (miles)	20.3	22.7	19.7	12.0
Closed Road				
Within a BMU (miles)	11.7	1.4	0.3	6.9
Within core habitat (miles)*	0.2	0.0	0.0	0.0
Within Cabinet Face BORZ (miles)	0.1	1.4	1.4	3.4
Subtotal (miles)	11.8	2.8	1.7	10.3
New Road				
Within a BMU(miles)	6.5	0.8	1.1	2.0
Within Core Habitat (miles)	0.9*	0.0	0.0	0.0
Within Cabinet Face BORZ (miles)	3.4	2.2	2.2	1.5
Subtotal (miles)	9.9	3.0	3.3	3.5

*Core habitat mileage is included with the mileage of the "Within a BMU" category.
BMU = Bear Management.
BORZ = Bears Outside Recovery Zone.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Roads built for the installation of the transmission line would be redisturbed during line reclamation. After the transmission line was removed, all newly constructed roads would be bladed, contoured, and seeded. Once vegetation was re-established, redisturbed areas would again provide forage habitat.

MMC's land acquisition program (see section 2.4.6.3, *Grizzly Bear Mitigation Plan*) would, in the long term, result in additional habitat available for grizzly bear use. Acquired parcels that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity. The land acquisition program would provide grizzly bear habitat over the long term. This additional habitat would be important in providing space and security for an increasing grizzly bear population.

Displacement and percent habitat effectiveness. Point source and motorized linear disturbance are recognized as having potential displacement effects on bears. The effects of activities potentially resulting in the displacement of bears from their habitat is calculated by applying influence zones for point source and linear disturbances established in Christensen and Madel (1982) and USDA Forest Service (1988a). Displacement effects shown in Table 193 are worst-case scenario and include areas where other activities may currently be contributing to the displacement of grizzly bears. Displacement effects from new and open roads, clearing, and

construction of structures associated with the transmission line alternatives are entirely encompassed by the helicopter displacement buffer.

In Alternative B, helicopter use and other construction activities would result in potential displacement effects to 14,901 acres of grizzly bear habitat. Helicopter line stringing would last about 10 days, and would result in short-term disturbance to grizzly bears. Similar effects could occur from other transmission line construction activities in areas where helicopters were not used, and would be more extensive for Alternative B than the agencies' alternatives. Except for annual inspection and infrequent maintenance operations, which would last about 10 days, helicopter use and other transmission line construction activities would cease after transmission line construction until decommissioning. Helicopter use and other activities would cause similar disturbances with similar durations during line decommissioning.

Increased displacement effects would result in a decrease in HE, especially during transmission line construction. Because it is not possible to attribute road access changes associated with mitigation to transmission line alternatives independent of mine alternatives, HE was not calculated for Alternative B, but can be inferred from Table 195. Displacement effects from helicopter use and other construction activities would have the greatest impact on HE in BMU 6, where HE is currently below the recommended level.

Displacement effects and impacts on HE would diminish after transmission line construction because helicopter line construction would cease and roads opened or constructed for transmission line access would be gated or barriered after transmission line construction. In Alternative B, infrequent disturbance to grizzly bears would occur during transmission line operations as a result of annual inspections and maintenance conducted by helicopter. Helicopters would be used for line decommissioning. Scientific literature suggests that high frequency helicopter use, particularly at low altitudes, in grizzly bear habitat can result in adverse effects on grizzly bears (Montana/Northern Idaho Level I Team 2006). Disturbance from helicopters may result in flight responses and other behavioral changes, increased heart rate and other physiological changes, displacement to lower quality habitat, and increased energetic demands (Ibid.). When the transmission line was decommissioned following mining, the access roads would be reopened, the transmission line would be removed, roads reclaimed, trees along the line allowed to grow, and all disturbed areas revegetated. After reclamation, the HE would return to existing levels.

To mitigate for habitat losses not offset by access changes, Alternative B includes the protection of private lands through acquisition or conservation easement. Displacement effects would be reduced through MMC's land acquisition program. Acquired parcels that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity. The land acquisition program would partially offset the Alternative B impacts to habitat effectiveness through road access changes and elimination of sources of grizzly bear disturbance, where possible.

Core habitat and open road densities. Alternative B would increase linear ORD to about 0.71 mi/mi^2 in BMU 6 during construction, but would remain better than the standard. Linear ORD in BMU 6 would be the same as existing conditions after reclamation. Alternative B would have the greatest effects on OMRD in BMU 6, increasing OMRD to 38 percent during construction. In Alternative B, OMRD in BMU 6 would be the same as existing conditions during operations and after reclamation. In BMU 6, Alternative B would increase TMRD during construction and

operations, but would return to existing densities after reclamation. Construction of Alternative 2B would decrease core habitat to 53 percent in BMU 6 during construction, where core habitat is currently worse than recommended levels; it can be inferred from these results that Alternative B would have similar effects on core habitat. Impacts to core habitat would be partially reduced through MMC proposed land acquisition program. Acquired parcels that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity, and could contribute additional core habitat where core habitat conditions occurred and where roads were barriered.

Small, isolated blocks of core habitat may provide lower quality habitat than large, interconnected blocks. Research suggests that grizzly bears prefer larger blocks of core, although a minimum block size was not determined due to small sample sizes (Wakkinen and Kasworm 1997). During transmission line construction, new road construction in Alternative B would divide and reduce a block of core habitat in the northeast portion of BMU 6, where a narrow band of core habitat occurs, resulting in one large block and two smaller blocks from project construction until the transmission line was decommissioned. Displacement effects from helicopter activity during line stringing, annual maintenance throughout the project, and transmission line decommissioning would reduce effectiveness of this core habitat block. Core grizzly bear habitat would be altered with a linear transmission line corridor, reducing cover and increasing forage habitat. Clearing of the transmission line corridor could result in improved hunter access, increasing mortality risk.

Opening size. One linear opening in forest cover greater than 40 acres would be created by Alternative B. No location in the transmission line clearing area would be greater than 600 feet from cover.

Movement corridors. In Alternative B, unharvested corridors greater than 600 feet would continue to be maintained between proposed activity and unrecovered existing harvest units. None of the Alternative B components or activities would affect linkage zones identified by Servheen *et al.* (2003). Alternative B could deter grizzly bears from moving along the Miller Creek, Howard Creek, and Ramsey Creek drainages, but these displacement effects would only occur during transmission line construction.

Seasonal components. In Alternative B, no motorized activity associated with transmission line construction would occur from April 1 to June 15 within bear habitat in the Miller Creek and Midas Creek drainages; timing restrictions in other areas would not be applied. Alternative B developments and activities would occur entirely in grizzly bear spring range. Disturbance due to noise and the presence of humans and machinery would have the greatest impact on grizzly bears if conducted in the spring (April 1 to June 15). Mitigation to secure currently disturbed spring habitat through other access management actions would be implemented.

Mortality risk. In Alternative B, food attractants would be minimized through the use of bear-resistant garbage containers, prohibiting the feeding of bears by mine employees, and the prompt removal of roadkill. Although new transmission line access roads would be gated or barriered after transmission line construction, mortality risks could increase due to improved hunter or poacher access. Mortality risks due to improved hunter or poacher access would increase more for Alternative B than for other transmission line alternatives because more new roads would be built (Table 194). Under MMC's proposed alternative, MMC would fund two new FWP wildlife positions—a bear specialist and a law enforcement officer. Public education about grizzly bears and enforcement of laws protecting grizzly bears would minimize mortality risks.

Outside Recovery Zone

On National Forest System lands, Alternative B would not measurably change existing conditions for linear ORD and TRD, livestock grazing, or the availability of food attractants for the grizzly bear in the Cabinet Face BORZ.

Alternative B would involve the construction of about 3.4 miles of new access road on private land in the Cabinet Face BORZ (Table 194). Roads opened or constructed for transmission line access on private land would be gated after transmission line construction and reclaimed during the final reclamation phase. Helicopter use during construction of Alternative B could result in increased disturbance to grizzly bears on private land, potentially displacing them from suitable habitat. New access roads, helicopter use, and other construction activities would likely have minimal impacts to grizzly bears because road densities are currently high on private and state land within the Alternative B transmission line corridor, the area is infrequently used by grizzly bears, and public education and law enforcement efforts of the bear specialist and law enforcement officer would minimize the risk of increased grizzly bear mortality.

The clearing area for Alternative B includes about 132 acres of private lands in the Cabinet Face BORZ. Actual clearing would likely be less, depending on tree height, slope, and line distance above the ground. Most of these lands have been logged in the past 20 to 30 years. Construction of the Sedlak Park Substation and loop line would result in the loss of about 4.4 acres of previously harvested coniferous forest. With the exception of the substation site and new access roads, disturbed areas would be revegetated after transmission line construction, potentially providing additional forage habitat for grizzly bears. On private land in the Cabinet Face BORZ, the clearing area for Alternative B includes about 9 acres of wetlands/riparian habitat, providing potential grizzly bear feeding areas. Direct effects to wetlands are expected to be mostly avoided by locating transmission line facilities and roads outside of wetlands and waters of the U.S. Less than 0.1 acre of wetlands and waters of the U.S. would be affected by new or upgraded road construction. Impacts to wetlands and riparian areas also would be minimized through implementation of MMC's proposed grizzly bear mitigation plan (see section 2.4.6.3.1, *Habitat Protection*) and the Environmental Specifications (Appendix D).

The eastern portion of the Alternative B transmission line alignment would occur within the wildlife linkage zone in the Fisher River Valley. The proximity of this alignment to U.S. 2 would result in a widening of disturbed area and could potentially discourage grizzly bear movement within the linkage zone by decreasing cover. Transmission line construction activities could affect grizzly bear movement within this linkage zone, but these effects would be short-term because human-caused disturbance would cease when the transmission line construction was completed. Once revegetated, cleared areas could provide additional forage habitat. Some shrub and tree cover would be maintained in the transmission line right-of-way because only the largest trees would be removed. Given that the area of the linkage zone potentially affected by Alternative B is generally heavily roaded and has been logged in the past 20 to 30 years, and given the short-term nature of human-caused disturbance, it is not likely that grizzly bear movement within the linkage zone would be greatly affected by Alternative B.

Alternative C – Modified North Miller Creek Transmission Line Alternative

Inside Recovery Zone

Physical habitat disturbance. Alternative C would result in the clearing of about 156 acres within BMUs 5 and 6, and the physical removal of about 13 acres of potential grizzly bear habitat

as a result of new roads (Table 193). All roads on National Forest System lands would be placed in intermittent stored service. Intermittent stored service roads would be closed to traffic and would be treated so they would cause little resource risk if maintenance were not performed on them during the operation period of the mine and prior to their future need.

National Forest System land. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction. New transmission line roads on National Forest System lands would be decommissioned after closure of the mine and removal of the transmission line. Decommissioned roads would be removed from service and would receive a variety of treatments to minimize the effects on other resources. Once vegetation was re-established, redisturbed areas would again provide forage habitat. Reclamation of all disturbed areas would be similar to Alternative B.

To mitigate for habitat losses not offset by access changes, agencies' alternatives include the protection of private lands through acquisition or conservation easement. The agencies' land acquisition program would, in the long term, result in additional habitat available for grizzly bear use. Acquired parcels that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity. The land acquisition program would likely result in a net gain in grizzly bear habitat over the long term. This additional habitat would be important in providing space and security for an increasing grizzly bear population.

Displacement and percent habitat effectiveness. In Alternative C, helicopters would be used for logging, structure placement, line stringing, annual inspections and maintenance, and line decommissioning, resulting in potential displacement effects to 12,582 acres of grizzly bear habitat. As with Alternative B, helicopter disturbance could be prolonged for up to 2 months. Vegetation clearing and structure placement where helicopters were not used could also contribute to short-term displacement effects. Some areas affected by displacement from transmission line activities are currently being affected by other activities such as road use. Alternatives B and C would follow similar routes, with the exception of the segment of Alternative B in the Ramsey Creek drainage. Alternative C would increase short-term helicopter displacement effects during construction but would reduce road requirements relative to Alternative B. Displacement effects from new and open roads, clearing, and construction of structures associated with the transmission line alternatives occur entirely within the helicopter displacement buffer. Except for annual inspection and infrequent maintenance operations, helicopter use and other transmission line construction activities would cease after transmission line construction until decommissioning. Effects of high frequency helicopter use, particularly at low altitudes, are discussed in Alternative B.

Increased displacement effects would decrease HE, especially during transmission line construction. Because it is not possible to attribute road access changes associated with mitigation to transmission line alternatives independent of mine alternatives, HE was not calculated for Alternative C, but can be inferred from Table 195. Displacement effects from helicopter use and other construction activities would have the greatest impact on HE in BMU 6, where HE is currently below the recommended level. Displacement effects and reduction in HE after transmission line construction would be the same as Alternative B.

The agencies' alternatives include considerably more acquisition or placement of conservation easements on private land than Alternative B. The agencies' land acquisition program would, in the long term, result in additional habitat available for grizzly bear use. The land acquisition

program would likely result in a net gain in grizzly bear habitat effectiveness through road access changes and elimination of sources of grizzly bear disturbance, where possible.

Core and open road densities. During construction, Alternative C would increase linear ORD to 0.67 mi/mi^2 in BMU 6, but would remain better than the standard. In Alternative C, linear ORD would return to existing densities after transmission line construction. Alternative C would increase OMRD in BMU 6, where OMRD is worse than the standard, to 37 percent during construction. OMRD would return to existing densities after transmission line construction. In Alternative C, TMRD would not change in BMU 6 during construction, and would be better than existing conditions after transmission line construction. In BMU 6, where core habitat is currently worse than recommended levels, Alternative C would improve core habitat to better than recommended levels during all phases of the project.

The transmission line alignment in Alternative C would cross a block of core habitat in the northeast portion of BMU 6, but would not reduce core habitat because helicopters would be used for construction in or adjacent to core habitat. Similar to Alternative B, displacement effects from helicopter activity during construction, annual maintenance throughout the project, and transmission line decommissioning in Alternative C would reduce effectiveness of this core habitat block during transmission line construction. Alternative C includes an access change in the upper 2.8 miles of NFS road #4725 that would enlarge the block of core habitat in the northeast portion on BMU 6 after the road was no longer needed for transmission line construction. The effects of habitat alteration of core habitat due to clearing in the transmission line corridor would be the same for Alternative C as Alternative B.

Opening size. One linear opening in forest cover greater than 40 acres would be created by Alternative C. No location in the transmission line clearing area would be greater than 600 feet from cover.

Movement corridors. In Alternative C, unharvested corridors greater than 600 feet would continue to be maintained between proposed activity and unrecovered existing harvest units. None of the Alternative C components or activities would affect linkage zones identified by Servheen *et al.* (2003). Alternative C could deter grizzly bears from moving along the Miller Creek, Howard Creek, and Libby Creek drainages, but these displacement effects would only occur during transmission line construction.

Seasonal components. In Alternative C, timing restrictions would not be applied. Alternative C developments and activities would occur entirely in grizzly bear spring range. Disturbance due to noise and the presence of humans and machinery would have the greatest impact on grizzly bears if conducted in the spring (April 1 to June 15). Road access changes associated with Alternative C mitigation would secure currently disturbed spring habitat. Quality and quantity of spring habitat also would be improved through agencies' land acquisitions and habitat improvements.

Mortality risk. In Alternative C, food attractants would be minimized within the Recovery Zone, the same as Alternative B. Mortality risks due to improved hunter or poacher access would be less for Alternative C than Alternative B because fewer new roads would be built (Table 194). In addition to the bear specialist and law enforcement positions funded by MMC in Alternative B, Alternative C includes the funding by MMC of an additional bear specialist. Public education about grizzly bears and enforcement of laws protecting grizzly bears would minimize mortality risks.

Outside Recovery Zone

Alternative C would not measurably change existing conditions on National Forest System lands for linear ORD, TRD, or livestock grazing. In Alternative C, MMC would provide funding for fencing and electrification of garbage transfer stations in grizzly habitat in and adjacent to the Cabinet-Yaak Ecosystem, such as the Lincoln County collection dumpsters located adjacent to U.S. 2 at the eastern edge of the BORZ polygon, reducing the availability of food attractants and reducing mortality risks for the grizzly bear in the Cabinet Face BORZ. Alternative C would require the construction of about 2.2 miles of new access road on private land in the Cabinet Face BORZ (Table 194). Roads opened or constructed for transmission line access on private land would be gated after transmission line construction and reclaimed during the final reclamation phase. Helicopter use during construction of Alternative C could result in increased disturbance to grizzly bears on private land, potentially displacing them from suitable habitat. New access roads associated with Alternative C on private land would likely have minimal impacts to grizzly bears because road densities are currently high on private land within the Alternative C transmission line corridor, the area is infrequently used by grizzly bears, and public education and law enforcement efforts of the bear specialists and law enforcement officer would minimize the risk of increased grizzly bear mortality.

The clearing area for Alternative C includes about 170 acres of private lands in the Cabinet Face BORZ. Actual clearing would likely be less, depending on tree height, slope, and line distance above the ground. Most of these lands have been logged in the past 20 to 30 years. Construction of the Sedlak Park Substation and loop line would result in the loss of about 4.4 acres of previously harvested coniferous forest. With the exception of the substation site and new substation access roads, disturbed areas would be revegetated after transmission line construction, potentially providing additional forage habitat for grizzly bears. On private land in the Cabinet Face BORZ, the clearing area for Alternative C includes about 2 acres of wetlands/riparian habitat, providing potential grizzly bear feeding areas. Direct effects to wetlands are expected to be mostly avoided by locating transmission line facilities and roads outside of wetlands and waters of the U.S. Less than 0.1 acre of wetlands and waters of the U.S. would be affected by new or upgraded road construction. Impacts to wetlands and riparian areas also would be minimized through implementation of the agencies' Wetland Mitigation Plan (section 2.5.7.1, *Wetland Mitigation*) and Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*), and the Environmental Specifications (Appendix D). As specified in the agencies' Wildlife Mitigation Plans (sections 2.5.7.3, *Wildlife Mitigation* and 2.9.4, *Wildlife Mitigation Measures*), all shrub habitat would be retained in wetlands and riparian areas crossed by the proposed transmission line, minimizing impacts to grizzly bear forage habitat.

A relatively small portion of the Alternative C transmission line would cross the Fisher River Valley in the Fisher River wildlife linkage zone, potentially discouraging grizzly bear movement in a localized area due to transmission line construction activities. These effects would be short-term because human-caused disturbance would cease when the transmission line was built. The portion of Alternative C that would parallel U.S. 2 would be located upslope and out of the Fisher River Valley, and would not likely affect grizzly bear movement in the linkage zone. Given that the area of the linkage zone potentially affected by Alternative C is generally heavily roaded and has been logged in the past 20 to 30 years, and given the short-term nature of human-caused disturbance, it is not likely that this alternative would greatly affect grizzly bear movement within the Fisher River Valley linkage zone.

Alternative D – Miller Creek Transmission Line Alternative

Inside Recovery Zone

Physical habitat disturbance. Physical habitat disturbance resulting from Alternative D would be the same as Alternative C, except that Alternative D would disturb about 163 acres within BMUs 5 and 6 and physically remove about 14 acres of grizzly bear habitat as a result of new roads (Table 193). The effects of the mitigation would be the same as Alternative C.

Displacement and percent habitat effectiveness. Impacts to displacement and habitat effectiveness from Alternative D would be the same as Alternative C, except that in Alternative D, helicopter construction and line stringing would result in potential displacement effects to 13,576 acres of grizzly bear habitat. Mitigation for impacts to displacement and habitat effectiveness would be the same as Alternative C.

Core and open road densities. During all phases, Alternative D would not change linear ORD or OMRD in BMU 6, and would improve TMRD in BMU 6. Alternative D would increase percent core habitat in BMU 6 to better than recommended levels. Alternative D includes an access change in NFS road #4725 that would enlarge a narrow band of core habitat in the northeast portion on BMU 6. The access change would be in the entire length of NFS road #4725 and would be implemented before transmission line construction started.

Opening size. One linear opening in forest cover greater than 40 acres would be created by Alternative D. No location in the transmission line clearing area would be greater than 600 feet from cover.

Movement corridors. In Alternative D, unharvested corridors greater than 600 feet would continue to be maintained between proposed activity and unrecovered existing harvest units. None of the Alternative D components or activities would affect linkage zones identified by Servheen *et al.* (2003). Alternative D could deter grizzly bears from moving along the Miller Creek, Howard Creek, and Libby Creek drainages, but these displacement effects would only occur during transmission line construction.

Seasonal components. The impacts of Alternative D on grizzly bear seasonal habitat use would be the same as Alternative C.

Mortality risk. Effects on mortality risk from Alternative D would be the same as Alternative C.

Outside Recovery Zone

On National Forest System National Forest System lands, Alternative D would not measurably change existing conditions for linear ORD and TRD or livestock grazing. In Alternative D, MMC would provide funding for fencing and electrification of garbage transfer stations in grizzly habitat in and adjacent to the Cabinet-Yaak Ecosystem, such as the Lincoln County collection dumpsters located adjacent to U.S. 2 at the eastern edge of the BORZ polygon, reducing the availability of food attractants for the grizzly bear in the Cabinet Face BORZ. Impacts to grizzly bears from Alternative D on private land in the Cabinet Face BORZ would be the same as Alternative C, except that the clearing area for Alternative D includes about 182 acres (Table 193 and Table 194).

Impacts of Alternative D on grizzly bears in the wildlife linkage zone in the Fisher River Valley would be the same as Alternative C.

Alternative E – West Fisher Creek Transmission Line Alternative

Inside Recovery Zone

Physical habitat disturbance. Physical habitat disturbance resulting from Alternative E would be similar to Alternative D, except that Alternative E would disturb about 192 acres within BMUs 5 and 6 (Table 193). The effects of the mitigation would be the same as Alternative C.

Displacement and percent habitat effectiveness. Impacts to displacement and habitat effectiveness from Alternative E would be the same as Alternative D, except that in Alternative E, helicopter construction and line stringing would result in potential displacement effects to 16,501 acres of grizzly bear habitat. Mitigation for impacts to displacement and habitat effectiveness would be the same for Alternative E as Alternative C.

Core and open road densities. During construction, Alternative E would increase linear ORD the most in BMU 6, but would remain better than the standard. Linear ORD would return to existing densities after transmission line construction. Effects of Alternative E on OMRD would be the same as Alternative C. In BMU 6, effects of Alternative E on TMRD and core habitat would be the same as Alternative D. Alternative E includes the same access change in NFS road #4725 as Alternative D that would enlarge a narrow band of core habitat in the northeast portion on BMU 6.

Opening size. No new non-linear openings in forest cover greater than 40 acres would be created by Alternative E. No location in the transmission line clearing area would be greater than 600 feet from cover.

Movement corridors. In Alternative E, unharvested corridors greater than 600 feet would continue to be maintained between proposed activity and unrecovered existing harvest units. None of the Alternative E components or activities would affect linkage zones identified by Servheen *et al.* (2003). Alternative E could deter grizzly bears from moving along the West Fisher Creek, Howard Creek, and Libby Creek drainages, but these displacement effects would only occur during transmission line construction.

Seasonal components. The impacts of Alternative E on grizzly bear seasonal habitat use would be the same as Alternative C.

Mortality Risk. Effects on mortality risk from Alternative E would be the same as Alternative C.

Outside Recovery Zone

On National Forest System lands, Alternative E would not measurably change existing conditions for linear ORD and TRD or livestock grazing. In Alternative E, MMC would provide funding for fencing and electrification of garbage transfer stations in grizzly habitat in and adjacent to the Cabinet-Yaak Ecosystem, such as the Lincoln County collection dumpsters located adjacent to U.S. 2 at the eastern edge of the BORZ polygon, reducing the availability of food attractants for the grizzly bear in the Cabinet Face BORZ. Impacts to grizzly bears from Alternative E on private and state land in the Cabinet Face BORZ would be the same as Alternative D, except that Alternative E would involve the construction of about 1.5 miles of new access road (Table 194), and the clearing area for Alternative E includes about 163 acres (Table 194 and Table 193), including about 17 acres of wetlands/riparian habitat.

Impacts of Alternative E on grizzly bears in the wildlife linkage zone in the Fisher River Valley would be the same as Alternative C.

Combined Mine-Transmission Line Effects

Alternative 1A would not change existing conditions for the grizzly bear inside or outside the recovery zone. None of the action alternatives would change existing conditions for the grizzly bear in BMU 2.

Inside Recovery Zone

Percent habitat effectiveness. All of the combined action alternatives would decrease HE to worse than the recommended level in BMUs 5 and 6 during transmission line construction and operations (Table 195), mostly due to displacement effects from helicopter line stringing and construction. For all combined action alternatives, helicopter and other activities associated with transmission line construction could result in short-term disturbance to grizzly bears. Disturbance from helicopter use and other transmission line construction activities are described for Alternatives B and C above.

For Alternatives 4C, 4D, and 4E, HE would improve compared to existing levels in BMUs 5 and 6 after reclamation. HE would return to existing levels in BMUs 5 and 6 after reclamation in all other combined action alternatives.

During construction and operations, the combined agencies' alternatives would have the same effects on HE in BMU 5, reducing HE to 68 percent during construction and 70 percent during operations. Alternative 2B would have greater effects to HE in BMU 5 than the other alternatives, reducing HE to 61 percent during construction and 66 percent during operations, mostly because effects of the Ramsey Plant Site would occur in a separate drainage than other mine features.

In BMU 6, Alternatives 3E and 4E would reduce HE the most during construction due to a larger extent of helicopter use and other construction activities. Alternatives 2B, 3C, and 4C would reduce HE in BMU 6 the least during construction. During operations, Alternatives 2B, 3C, and 4C would decrease HE in BMU 6 the most because an access change in the lower segment of NFS road #4725 would occur for Alternatives 3D, 4D, 3E, and 4E only.

In all combined action alternatives, impacts to HE would be reduced through MMC and agencies' land acquisition programs. Acquired parcels that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity. The agencies anticipate additional land acquisition beyond that proposed by MMC would be necessary to mitigate all effects. The agencies' land acquisition program would likely result in a net gain in grizzly bear habitat effectiveness, through road access changes and elimination of sources of grizzly bear disturbance, where possible.

Linear open road density. All of the combined action alternatives would result in increases in linear ORD in BMU 5 during construction and operations, and in BMU 6 during construction. Linear ORD resulting from Alternative 2B construction would be 0.78 mi/mi^2 in BMU 5, which would be worse than the standard. During construction, Alternative 2B would increase ORD in BAAs 555 and 556, where current ORD is worse than the standard. Results of the analysis of the effects of the combined mine-transmission line alternatives on ORD in the individual BAAs are in the KNF project record.

Table 195. Grizzly Bear Habitat Effects by Combined Mine-Transmission Line Alternative[1].

Habitat Component	[1A] No Action/ Existing Conditions	[2] MMC's Proposed Mine			[3] Agency Mitigated Poorman Impoundment Alternative									[4] Agency Mitigated Little Cherry Creek Impoundment Alternative								
		TL-B			TL-C			TL-D			TL-E			TL-C			TL-D			TL-E		
		C	O	R	C	O	R	C	O	R	C	O	R	C	O	R	C	O	R	C	O	R
BMU 2																						
Core %	76 (≥55 or no loss)	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76
OMRD %	20 (no net increase)	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
TMRD %	14 (no net increase)	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
HE %	79 (≥70)	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79
Linear ORD	0.30 (≤0.75)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
BMU 5																						
Core %	60 (≥55 or no loss)	**58**	**58**	**59**	65	66	66	65	65	66	65	65	66	65	65	66	65	65	66	65	65	66
OMRD %	27 (no net increase)	32	30	26	29	29	26	29	29	26	29	29	26	29	29	25	29	29	25	29	29	25
TMRD %	23 (no net increase)	26	26	21	20	18	18	20	18	18	20	20	18	20	20	17	20	20	17	20	20	17
HE %	72 (≥70)	**61**	**66**	72	**68**	70	72	**68**	70	72	**68**	70	72	**68**	70	73	**68**	70	73	**68**	70	73
Linear ORD	0.52 (≤0.75)	**0.78**	0.65	0.50	0.62	0.62	0.47	0.63	0.62	0.47	0.63	0.62	0.47	0.60	0.60	0.46	0.60	0.60	0.46	0.61	0.60	0.46
BMU 6																						
Core %	**54** (≥55 or no loss)	**53**	**53**	**53**	55	56	56	57	57	57	57	57	57	55	56	56	57	57	57	57	57	57
OMRD %	35 (no net increase)	38	35	35	37	35	35	35	35	35	37	35	35	37	35	35	35	35	35	37	35	35
TMRD %	33 (no net increase)	34	34	33	33	32	32	32	32	32	32	32	32	33	32	32	32	32	32	32	32	32
HE %	**66** (≥70)	**62**	**64**	66	**62**	**64**	66	**61**	**65**	66	**59**	**65**	66	**62**	**64**	66	**61**	**65**	66	**59**	**65**	66
Linear ORD	0.63 (≤0.75)	0.71	0.63	0.63	0.67	0.63	0.63	0.63	0.63	0.63	0.74	0.63	0.63	0.67	0.63	0.63	0.63	0.63	0.63	0.74	0.63	0.63

[1] The habitat parameters in this table do not reflect potential improved conditions that could result from required land acquisitions associated with mitigation for each alternative. Values in parentheses represent KFP standards or goals and measures developed to meet KFP objectives and comply with the ESA based on consultations since 1987; USFWS (1995); IGBC (1998); and best science applicable to the Montanore Project (Wakkinen and Kasworm 1997).

For existing conditions, bolded values do not meet standards or goals. For alternatives, bolded values do not meet standards or goals, and do not maintain or improve conditions for that habitat parameter. Habitat parameters that do not meet standards or goals but that are not worse than existing conditions are not bolded. Compliance with OMRD and TMRD direction is based on reclamation phase values only.

TL = Transmission Line Alternative.
C = Construction Phase – shown with mitigation in place as mitigation plan requires this before start of construction phase.
O = Operation Phase – includes all mitigation in place.
R = Reclamation Phase (post project) – includes all mitigation in place.
BMU = Bear Management Unit.
ORD = open road density, measured in mi/mi^2.
OMRD = open motorized route density.
TMRD = total motorized route density.
HE = habitat effectiveness.

None of the combined agencies' alternatives would increase linear ORD to worse than the standard in BMU 5. Of the combined agencies' alternatives, Alternatives 3D and 3E would result in the greatest linear ORD in BMU 5 during construction. After reclamation, linear ORD in BMU 5 from all combined action alternatives would decrease below existing densities.

In all combined action alternatives, linear ORD in BMU 6 would be the same as existing conditions during operations and after reclamation. None of the combined action alternatives would result in linear ORD in BMU 6 worse than the standard. Due to the greater number of new roads needed for Alternative E, Alternatives 3E and 4E would increase linear ORD in BMU 6 the greatest during construction. Alternatives 3D and 4D would increase ORD in BMU 6 the least during construction.

Open motorized route density. All combined action alternatives would increase OMRD in BMU 5 during construction and operations (Table 195). Alternative 2B would have the greatest effects on OMRD in BMU 5, increasing OMRD to 32 percent during construction and 30 percent during operations. OMRD in BMU 5 would be similar in all agencies' alternatives, except after reclamation. OMRD in BMU 5 would improve compared to existing densities after reclamation in all combined action alternatives, decreasing by 2 percent for Alternatives 4C, 4D, and 4E; and 1 percent for Alternatives 2B, 3C, 3D, and 3E. Compliance with OMRD direction is based on values after reclamation.

OMRD in BMU 6 during construction would be worse than existing densities for Alternatives 2B, 3C, 3E, 4C, and 4E. OMRD in BMU 6 would increase more in Alternative 2B than other alternatives. OMRD in BMU 6 would return to existing densities during operations and after reclamation in all combined action alternatives.

Total motorized route density. In BMU 5, TMRD would increase the most during construction and operations of Alternative 2B to 26 percent. After reclamation, TMRD would be better than existing densities in BMU 5 for Alternative 2B. TMRD in BMU 5 would be better than existing densities for all phases of the combined agencies' alternatives, improving by 5 to 6 percent after reclamation (Table 195). Compliance with OMRD direction is based on densities after reclamation.

In BMU 6, TMRD would be the greatest during construction and operations of Alternative 2B, where TMRD would be 34 percent. TMRD would be 32 percent, or 1 percent better than existing densities, for Alternatives 3D, 3E, 4D, and 4E during construction and operations. During construction of Alternatives 3C and 3D, TMRD would be 33 percent because an access change in the lower segment of NFS road #4725 would occur for transmission line Alternatives 3D, 4D, 3E and 4E only. In all combined action alternatives, TMRD in BMU 6 would be the same as or slightly better than existing densities after reclamation.

Core areas. Relative to other combined action alternatives, Alternative 2B would have the greatest impact on core habitat in BMU 5 (Table 195). Alternative 2B would reduce core habitat in BMU 5 to 58 percent during construction and operations, and would result in less core habitat than existing levels after reclamation, mostly due to the effects of the Ramsey Plant Site. Combined agencies' alternatives would improve core habitat in BMU 5 during all phases of the proposed project as a result of road access changes and less new road construction along the transmission line corridors. Core in BMU 5 would be better than the recommended level in all combined action alternatives during all phases of the proposed project.

In BMU 6, Alternative 2B would decrease core habitat to 53 percent during all phases of the project. All combined agencies' alternatives would improve core habitat by between 1 and 3 percent in BMU 6 during all phases of the project as a result of road access changes and less new road construction along the transmission line corridors. All combined agencies' alternatives include an access change in NFS road #4725 that would improve core habitat in BMU 6. In Alternatives 3D, 4D, 3E, and 4E, the access change would be in the entire length of NFS road #4725 and would be implemented before transmission line construction started. The entire length of NFS road #4725 would be used during construction of Alternatives 3C and 4C, and the access change would occur in the upper 2.8 miles of NFS road #4725 after it was no longer needed for transmission line construction. For Alternatives 3C and 4C, less core habitat would be created than for Alternatives 3D, 4D, 3E, and 4E and core habitat creation would occur later.

The transmission line routes for combined alternatives 2B, 3C, and 4C would cross a narrow band of core habitat in the northeast portion of BMU 6. The effects of the combined alternatives to this core habitat block are described above for the corresponding transmission line alternatives.

In all combined action alternatives, impacts to core habitat would be reduced through MMC and agencies' land acquisition programs. Acquired parcels that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity, and could contribute additional core habitat where core habitat occurred and where roads were barriered. This additional habitat would be important in providing space and security for an increasing grizzly bear population. The agencies anticipate additional land acquisition beyond that proposed by MMC would be necessary to mitigate all effects.

Opening size. All combined action alternatives would result in one linear opening in forest cover greater than 40 acres as a result of surface disturbance associated with the transmission line. No location in the transmission line clearing area would be greater than 600 feet from cover. In all combined action alternatives, surface disturbance from the impoundments would result in the consolidation of two smaller openings into one large opening. Alternatives 2B, 3C, 3D, and 3E would create three additional openings with locations in the opening greater than 600 feet from cover as a result of other mine components. Mine components of Alternatives 4C, 4D, and 4E would create four additional openings with locations in the opening greater than 600 feet from cover.

Movement corridors. In all combined action alternatives, except for impoundment disturbance, unharvested corridors greater than 600 feet would continue to be maintained between the proposed activity and unrecovered existing harvest units. On a larger scale, movement corridors consisting of blocks of vegetative cover and core habitat are available across BMUs 5 and 6. None of the combined alternative components or activities would affect linkage zones identified by Servheen *et al.* (2003). All combined action alternatives could deter grizzly bears from moving along upper portions of the Libby Creek corridor. Alternatives 2B, 4C, 4D, and 4E could also disrupt grizzly bear movement in the Little Cherry Creek riparian area. Alternative 2B would have additional effects on grizzly bear movement in the Ramsey Creek corridor. These displacement effects would potentially last until mine closure. Due to disturbance associated with transmission line construction, Alternatives 2B, 3C, 3D, 4C, and 4D could deter grizzly bears from moving along the Miller, and Howard creek corridors. Alternatives 3E and 4E could affect grizzly bear movement along the West Fisher and Howard creek corridors. Potential disruption of grizzly bear movement during transmission line construction would subside during operations.

The combined agencies' alternatives would include the protection (through acquisition or conservation easement) of about 5 acres of grizzly bear habitat that would enhance the north to south habitat corridor in the Cabinet Mountains.

Seasonal components. In all combined action alternatives, mine-related activities would occur continuously along the east Cabinet front during the spring period (April 1 to June 15) throughout the life of the project. Alternative 2B would result in a long-term disturbance in the upper Ramsey Creek drainage, which lies directly adjacent to the CMW and core grizzly bear habitat. In all combined action alternatives, mine-related activities in Libby Creek also would occur in proximity of the CMW and core grizzly bear habitat. Bears that may have traditionally used the impacted areas during the spring would likely have to adjust their normal behavior patterns, perhaps seeking foraging sites in less productive areas or areas closer to human disturbance. Due to the magnitude and duration of the disturbance at the Ramsey Plant Site, Libby Plant Site, and Libby Adits, and the limited amount of foraging options available to bears in the spring, changes in spring habitat use may have adverse consequences for grizzly bear survival.

In all combined action alternatives, impacts to bears in spring would be reduced through MMC and agencies' land acquisition programs. Acquired parcels that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity, and could secure additional spring habitat where conditions were appropriate. One of the goals of the agencies' grizzly bear mitigation is to protect seasonally important habitats, with a primary emphasis on spring, and secondary emphasis on fall habitats.

Mortality risk. As a result of activity at the Ramsey Plant site and Libby Plant Site, bears may be displaced from important seasonal foraging areas during critical periods, and may need to seek foraging sites in areas closer to human disturbance. Displacement into habitat less secure from humans can result in increased mortality for bears (USFWS 1993).

As described in section 3.17, *Social/Economics*, it is assumed in all combined action alternatives that some temporary housing facilities would be developed near the project site on private lands, increasing the potential for grizzly bear mortality due to human-grizzly bear conflicts. Section 3.15, *Recreation* discusses that all combined action alternatives would increase recreational use of the analysis area in the long term. Increased recreational activity in bear habitat may also increase human/grizzly conflicts and grizzly bear mortality.

In all combined line alternatives, food attractants would be minimized through the use of bear-resistant garbage containers, prohibiting the feeding of bears by mine employees, and the prompt removal of roadkill. Alternative 2B would include the funding by MMC of two new wildlife positions: a bear specialist and a law enforcement officer (see Chapter 2). The new bear specialist would increase public awareness of grizzly bear biology and behavior, and help to increase acceptance and support of grizzly bear management. In addition to the new positions funded by MMC, the combined agencies' alternatives would include funding for an additional bear specialist. Public attitudes are a major part of the success or failure of grizzly bear recovery efforts. It is critical to the recovery effort that people understand reasons for agency actions in order to have a favorable attitude toward grizzly bears (USFWS 1993).

The combined action alternatives could result in increased grizzly bear mortality due to increased traffic. Because roads in the operating permit areas would be closed to the public, the risk of mortality from poaching would be minimized. Although new transmission line access roads

would be gated or barriered after transmission line construction, mortality risks could increase due to improved hunter or poacher access. Mortality risks due to improved hunter or poacher access would increase more for Alternative 2B than for other combined action alternatives because more new roads would be built (Table 194). The new law enforcement position included in MMC's grizzly bear mitigation plan (see section 2.4.6.3.1, *Habitat Protection*) would help deter illegal killing of grizzly bears in the area.

Outside Recovery Zone

On National Forest System lands, none of the combined mine-transmission line alternatives would measurably change existing conditions for linear ORD, TRD, and livestock grazing. Alternative 2B would not measurably change existing availability of food attractants for the grizzly bear in the Cabinet Face BORZ. The combined agencies' alternatives would include MMC funding for fencing and electrification of garbage transfer stations in grizzly habitat in and adjacent to the Cabinet-Yaak Ecosystem, such as the Lincoln County collection dumpsters located adjacent to U.S. 2 at the eastern edge of the BORZ polygon, reducing the availability of attractants, and reducing mortality risks for the grizzly bear in the Cabinet Face BORZ.

Assuming that some temporary housing facilities would be developed near the project site on private lands, food attractants may become more available in these areas. Alternative 2B would include the funding by MMC of a bear specialist and the combined agencies' alternatives would include funding for an additional bear specialist. Education of the public on food storage in bear habitat and increased awareness of grizzly bear behavior by the new grizzly bear specialists would help prevent human-bear conflicts.

Other potential impacts to grizzly bears in the Cabinet Face BORZ on private and state land would occur as a result of the transmission line. As shown in Table 194, the combined action alternatives would involve the construction of between about 1.5 and 3.4 miles of new access road on private land in the Cabinet Face BORZ. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction and reclaimed during the final reclamation phase. In all combined action alternatives, helicopter use during line stringing, maintenance, and inspections could result in increased disturbance to grizzly bears on private land, potentially displacing them from suitable habitat. New access road construction, helicopter use, and other construction activities would likely have minimal impacts to grizzly bears because road densities are currently high on private and state land within the alternative transmission line corridors and the area is infrequently used by grizzly bears. Public education and law enforcement efforts of the bear specialists and law enforcement officer would minimize the risk of increased grizzly bear mortality.

The clearing area for the combined action includes between 130 and 180 acres of private lands in the Cabinet Face BORZ.

On private land in the Cabinet Face BORZ, the clearing area for the combined action alternatives includes between 2 and 17 acres of wetlands/riparian habitat providing potential grizzly bear feeding areas. These effects were discussed previously under the individual effects of the transmission line alternatives.

The eastern segment of the Alternative 2B transmission line corridor would occur within the wildlife linkage zone in the Fisher River Valley. Relatively small segments of all combined action alternatives would cross the Fisher River Valley in the wildlife linkage zone. The portions of the

combined agencies' alternatives that would parallel U.S. 2 would be located upslope and out of the Fisher River Valley, and would not likely affect grizzly bear movement in the linkage zone. A relatively small portion of alternative transmission line corridors would cross the Fisher River Valley in the wildlife linkage zone, potentially discouraging grizzly bear movement in a localized area due to transmission line construction activities. However, these effects would be short-term because human-caused disturbance would cease when the transmission line was built. Given that the area of the linkage zone potentially affected by combined action alternatives is generally heavily roaded and has been logged in the past 20 to 30 years and, given the short-term nature of human-caused disturbance, it is not likely that these alternatives would greatly affect grizzly bear movement within the linkage zone. Impacts of the combined action alternatives are described for transmission line Alternatives B, C, and D above.

Incidental Take

Alternative 2B may cause incidental take for the following reasons:

- During all phases of the proposed project, Alternative 2B would result in losses of core habitat in BMUs 5 and 6, resulting in percent core habitat worse than recommended levels in BMU 6
- During construction, Alternative 2B would increase linear ORD to worse than the standard in BMU 5
- Alternative 2B would decrease HE to worse than objectives during construction and operations in BMUs 5 and 6
- Alternative 2B would create three additional openings with points in the opening greater than 600 feet from cover

Combined agencies' alternatives may cause incidental take for the following reasons:

- All combined agencies' alternatives would result in HE worse than recommended levels during construction in BMU 5 and construction and operations in BMU 6
- All combined agencies' alternatives would create three additional openings with points in the opening greater than 600 feet from cover

Cumulative Effects

Basic road maintenance, pre-commercial thinning, mushroom picking, prescribed burning, timber hauling, wildlife habitat improvement projects, and various recreational uses have occurred and would continue to occur within the analysis area. These activities are generally not considered to have adverse impacts on the grizzly bear. These activities may incidentally affect grizzly bear use within some areas on a temporary basis, but would not likely affect the viability of this species.

Roads constructed in association with timber harvest, mining, and other development have cumulatively reduced grizzly bear HE and core areas in the analysis area. Development of private lands within the analysis area, including commercial timber harvest, land clearing, home construction, and road construction has contributed to increased disturbance of grizzly bears, loss or reduction in quality of grizzly bear habitat, and increased human-grizzly bear conflicts, all of which are expected to continue. Fire suppression has resulted in the encroachment of conifers into foraging habitat and aging of shrub habitat. As noted in section 3.17, *Social/Economics*, population growth in the area is converting areas of private land from timber or agricultural

production and open space use into residential subdivisions and ranchettes, increasing the potential for additional food attractants and human-grizzly bear conflicts.

Road status information is available for the current and reasonably foreseeable Wayup Mine/Fourth of July Road Access Project, Plum Creek activities, the Rock Creek Project, and the Miller-West Fisher Vegetation Management Project. The cumulative effects of the mine and transmission line alternatives on percent core habitat, OMRD, TMRD, and linear ORD in BMUs 5 and 6 are shown in Table 196. Alternative 1A would not have cumulative impacts on the grizzly bear. None of the combined mine-transmission line alternatives or reasonably foreseeable actions would affect road status or contribute to cumulative road densities in BMU 2; cumulative effects on core and linear ORD are not displayed for BMU 2.

Inside Recovery Zone

Percent habitat effectiveness. All of the combined action alternatives, in combination with other reasonably foreseeable actions, would cumulatively decrease HE in BMUs 5 and 6, resulting in HE worse than recommended levels. Alternative 2B would decrease HE in BMU 5 more than other alternatives. In BMU 6, Alternatives 3E and 4E would contribute the most to cumulative reductions in HE. After reclamation, the combined mine-transmission line alternatives, in combination with other reasonably foreseeable actions, would improve HE relative to existing conditions.

Land acquisition programs associated with mitigation for the combined action alternatives and reasonably foreseeable actions, especially the Rock Creek Project, would reduce cumulative impacts to HE. Acquired parcels that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity. Land acquisition programs included in the combined action alternatives, especially the agencies' alternatives, would minimize or eliminate decreases in HE, through road access changes and elimination of sources of grizzly bear disturbance, where possible.

Linear open road density. Except for Alternatives 3D and 4D, all of the combined action alternatives, in combination with other reasonably foreseeable actions, would cumulatively increase linear ORD in BMU 6 during construction, resulting in cumulative ORD worse than recommended levels. During operations, combined action alternatives would not measurably contribute to cumulative increases in linear ORD in BMU 6. Cumulatively, linear ORD in BMUs 5 and 6 would be better than existing densities after reclamation.

Open motorized route density. All of the combined action alternatives, in combination with other reasonably foreseeable actions, would cumulatively increase OMRD in BMUs 5 and 6 during operations and construction. Alternative 2B would cumulatively increase OMRD in BMUs 5 and 6 during construction more than other alternatives. Cumulative OMRD in BMUs 5 and 6 would be better than existing levels after reclamation.

Total motorized route density. All of the combined action alternatives, in combination with other reasonably foreseeable actions, would cumulatively decrease TMRD in BMU 5 during all phases of the proposed projects. Construction of the combined agencies' alternatives, in combination with other reasonably foreseeable actions, would not change TMRD in BMU 6. Alternative 2B would cumulatively increase TMRD in BMU 6 during construction and operations. All combined action alternatives, in combination with other reasonably foreseeable actions, would decrease TMRD in BMUs 5 and 6 to better than existing levels after reclamation.

Table 196. Cumulative Effects on Grizzly Bear Core Habitat, Road Densities, and Habitat Effectiveness in BMUs 2, 5, and 6 by Combined Mine-Transmission Line Alternative.[1]

Habitat Component	Existing Conditions	[1] No Action[2]	[2] MMC's Proposed Mine			[3] Agency Mitigated Poorman Impoundment Alternative									[4] Agency Mitigated Little Cherry Creek Impoundment Alternative								
			TL-B			TL-C			TL-D			TL-E			TL-C			TL-D			TL-E		
			C	O	R	C	O	R	C	O	R	C	O	R	C	O	R	C	O	R	C	O	R
B M U 2																							
Core %	76 (≥55 or no loss)	76/76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76
OMRD %	20 (no net increase)	20/20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
TMRD %	14 (no net increase)	14/14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
HE %	79 (≥70)	79/79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79
Linear ORD	0.30 (≤0.75)	0.30/.030	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
B M U 5																							
Core %	60 (≥55 or no loss)	63/64	61	61	63	66	66	68	66	66	68	66	66	68	67	67	68	67	67	68	67	67	68
OMRD %	27 (no net increase)	26/26	30	29	26	28	28	25	28	28	25	29	28	25	28	28	24	28	28	24	28	28	24
TMRD %	23 (no net increase)	19/17	22	22	17	19	19	17	20	19	17	20	19	17	19	19	17	20	19	17	20	19	17
HE %	72 (≥70)	71/73	**61**	**65**	73	**66**	**67**	74	**66**	**67**	74	**66**	**67**	74	**66**	**67**	74	**66**	**67**	74	**66**	**67**	74
Linear ORD	0.52 (≤0.75)	0.46/0.46	0.71	0.62	0.46	0.59	0.59	0.44	0.60	0.59	0.44	0.60	0.59	0.44	0.57	0.57	0.43	0.58	0.57	0.43	0.58	0.57	.43
B M U 6																							
Core %	**54** (≥55 or no loss)	54/54	54	54	56	54	54	56	54	54	56	54	54	56	54	54	56	54	54	56	54	54	56
OMRD %	**35** (no net increase)	**37**/25	38	37	26	37	37	26	37	37	26	37	37	27	37	37	26	37	37	26	37	37	26
TMRD %	**33** (no net increase)	33/31	34	34	31	33	33	32	33	33	31	33	33	32	33	33	32	33	33	31	33	33	31
HE %	**66** (≥70)	61/73	**58**	**60**	73	**58**	**60**	73	**59**	**61**	73	**57**	**60**	72	**58**	**60**	73	**59**	**61**	73	**57**	**60**	73
Linear ORD	0.63 (≤0.75)	**0.88**/0.35	**0.91**	**0.88**	0.35	**0.89**	**0.88**	0.35	**0.88**	**0.88**	0.35	**0.90**	**0.88**	0.36	**0.89**	**0.88**	0.35	**0.88**	**0.88**	0.35	**0.90**	**0.88**	0.35

[1] The habitat parameters in this table do not reflect potential improved conditions that could result from required land acquisitions associated with mitigation for the alternatives or reasonably foreseeable actions.

[2] Effects shown are for other reasonably foreseeable actions only. Alternative 1 (No Transmission Line) would not contribute to cumulative effects on linear ORD.

Values in parentheses represent KFP standards or goals and measures developed to meet KFP objectives and comply with the ESA based on consultations since 1987; USFWS (1995); IGBC (1998); and best science applicable to the Montanore Project (Wakkinen and Kasworm 1997).

For existing conditions, bolded values do not meet standards or goals. For alternatives, bolded values do not meet standards or goals and do not maintain or improve conditions for that habitat parameter. Habitat parameters that do not meet standards or goals but that are not worse than existing conditions are not bolded. Compliance with OMRD and TMRD direction is based on reclamation phase values only.

Alt. = Mine Alternative.

TL = Transmission Line Alternative.

C = Construction Phase – shown with mitigation in place as mitigation plan requires this before start of construction phase.

O = Operation Phase – includes all mitigation in place.

R = Reclamation Phase (post project) – includes all mitigation in place.

BMU = Bear Management Unit; ORD = open road density, measured in mi/mi^2; OMRD = open motorized route density; TMRD = total motorized route density; HE = habitat effectiveness.

Core areas. Cumulatively, core habitat in BMUs 5 and 6 would be better than or equal to the recommended level in all combined action alternatives during all phases of the proposed project.

Opening size. Surface impacts from reasonably foreseeable actions in BMU 5 would be minimal, and would not result in any additional openings greater than 40 acres. In BMU 6, the combined mine-transmission line alternatives would not create any new openings greater than 40 acres with points greater than 600 feet from cover, and would not contribute to cumulative increases in forest openings that bears might avoid.

Movement corridors. None of the combined alternative components or activities would contribute to cumulative impacts to linkage zones identified by Servheen *et al.* (2003). The combined action alternatives, in combination with reasonably foreseeable actions such as the Rock Creek, Miller-West Fisher, and the Libby Creek Ventures projects, could result in cumulative disruptions of bear movement along riparian corridors. If activities associated with the Miller-West Fisher Vegetation Management Project and construction of the combined action alternatives occurred concurrently, grizzly bear movement may be particularly affected in either the Miller or West Fisher creek corridors, depending on the alternative.

Seasonal components. The combined action alternatives in combination with reasonably foreseeable actions would result in cumulative disturbance to grizzly bears during the spring period. The combined action alternatives and the Rock Creek Project would occur adjacent to, and on opposite sides of, the CMW and core habitat. The Miller-West Fisher Vegetation Management Project also would occur in grizzly bear spring habitat. Due to the magnitude and duration of the cumulative disturbances, and the limited amount of foraging options available to bears in the spring, changes in spring habitat use may have adverse consequences for bear survival.

Land acquisition programs associated with mitigation for the combined action alternatives and reasonably foreseeable actions, especially the Rock Creek Project, would reduce impacts to bears in spring. Acquired parcels that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity. Land acquisition programs included in the combined action alternatives, especially the agencies' alternatives, would counteract cumulative impacts to bears in spring through road access changes and elimination of sources of grizzly bear disturbance, where possible.

Mortality risk. The combined action alternatives, in combination with other reasonably foreseeable actions, could result in a cumulative increase in mortality risk due to the influx of employees and vehicles into the analysis area. The combined agencies' alternatives and the reasonably foreseeable actions would include measures to counteract the increased risk of grizzly bear mortality, such as busing employees to the project site, educating employees about the biology and behavior of grizzly bears, and equipping project sites and surrounding areas with bear-resistant garbage containers. The new law enforcement and bear specialist positions included in the combined action alternatives would help deter illegal killing of grizzly bears in the area, increase public awareness, and help to increase acceptance and support of grizzly bear management.

Outside Recovery Zone

On National Forest System lands, none of the reasonably foreseeable actions or the combined action alternatives would measurably change existing conditions for linear ORD and TMRD, livestock grazing, or food attractants for the grizzly bear in the Cabinet Face BORZ.

The combined action alternatives, in combination with reasonably foreseeable actions, could result in a cumulative increase in temporary housing facilities developed on private lands, potentially resulting in a cumulative increase in the availability of food attractants and human-grizzly bear conflicts. The bear specialists included in the combined action alternatives would help prevent human-bear conflicts by educating the public on food storage in bear habitat and increasing awareness of grizzly bear behavior.

As discussed in section 3.17, *Social/Economics*, many areas of private land are being converted from timber or agricultural production and open space use into residential subdivisions and ranchettes. The combined action alternatives, in combination with increased development of private land, could contribute to disturbance of grizzly bears on private land in the Cabinet Face BORZ. However, disturbance associated with combined action alternatives on private land in the Cabinet Face BORZ would be temporary, road densities are currently high on private and state land, and the area is infrequently used by grizzly bears. The cumulative impacts of the combined action alternatives on private land in the Cabinet Face BORZ would likely be minimal.

3.24.5.3.4 Regulatory/Forest Plan Consistency

KFP. None of the action alternatives would comply with KFP direction on threatened and endangered species that applies to the grizzly bear (KFP Vol. 1, II-1 #3 and #5, II-6, and II-22-23). All of the action alternatives would decrease HE below recommended levels during construction in BMU 5, and during construction and operations in BMU 6. All of the action alternatives would create three to four additional openings with points in the opening greater than 600 feet from cover. Additionally, Alternative 2 would not be in compliance with the KFP because it would increase linear ORD in BMU 5 to worse than the KFP standard and would result in a loss of core habitat in BMUs 5 and 6.

Endangered Species Act. For all alternatives, ESA compliance would be ensured through Section 7 consultation. The KNF will submit a BA to the USFWS that describes the potential effect on threatened and endangered species that may be present in the area. After review of the BA and consultation, the USFWS will issue a biological opinion (BO) for the proposed Montanore Project.

Statement of Findings. All of the action alternatives may affect, and are likely to adversely affect, the grizzly bear.

3.24.5.4 Canada Lynx

3.24.5.4.1 Analysis Area and Methods

Canada lynx population ecology, biology, habitat description, and relationships are described in Ruggiero *et al.* (2000) and Ruediger *et al.* (2000), and is incorporated herein by reference. In addition, the final lynx listing rule (Clark 2000) provides population and habitat status on a national scale. The most recent lynx distinct population segment status is found in the BO on the effects of the Northern Rocky Mountains Lynx Amendment (USFWS 2007c). Lynx occurrence

data come from KNF historical records (NRIS Fauna), KNF data (USDA Forest Service 2005c), and other agencies (MNHP, FWP, and USFWS).

The Final EIS for the Northern Rockies Lynx Management Direction (Lynx Amendment) was completed in 2007 with the ROD signed on March 23, 2007. This decision amended the KFP by providing lynx habitat management objectives, standards, and guidelines. The decision replaces the interim application of the Lynx Conservation Assessment and Strategy (LCAS) (Ruediger *et al.* 2000). In compliance with the LCAS, the KNF delineated 47 Lynx Analysis Units (LAUs) that approximate a lynx home range size (Figure 91). The direction provided in the Lynx Amendment is applied to lynx habitat at the LAU scale. Forest wide lynx habitat was mapped in compliance with LCAS project planning standard #1; an updated map reflecting the lynx habitat terminology from the Lynx Amendment is not yet available.

The effects analysis follows the objectives, standards, and guidelines established in the Lynx Amendment. As defined in the Lynx Amendment, an objective is a "statement in a land management plan describing desired resource conditions and intended to promote achieving programmatic goals." A guideline is "a particular management action that should be used to meet an objective found in a land management plan. The rationale for deviations may be documented, but amending the plan is not required." A standard is defined as "a required action in a land management plan specifying how to achieve an objective or under what circumstances to refrain from taking action. A plan must be amended to deviate from a standard" (USFWS 2007c). In compliance with the ROD for the Lynx Amendment, only the objectives, standards, and guidelines applicable to the proposed project are analyzed, and they are only applied to lynx habitat on National Forest System lands. Those standards and guidelines considered, but found "not applicable" are found in the KNF project record. Lynx habitat in affected LAUs was estimated based on the TSMRS.

Lynx habitat connectivity is provided by an adequate amount of vegetation cover arranged in a way that allows lynx movement. Connectivity was evaluated by visually examining lynx habitat and past management activities to determine possible movement areas and potential areas where lynx travel may be hindered. Ridgelines and draws were considered high value movement areas.

The analysis area for evaluating direct effects on National Forest System land is comprised of the West Fisher (14503) and Crazy (14504) LAUs (Figure 91). To evaluate potential direct and indirect impacts of the transmission line on lynx on private and state land, the analysis area includes all non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments. Indirect and cumulative effects are analyzed for the West Fisher and Crazy LAUs, adjacent LAUs (for effects on habitat connectivity), and any non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments.

Analysis of Impacts to Lynx on National Forest System Lands

The objectives, standards, and guidelines developed to meet these objectives, established in the Lynx Amendment applicable to the Montanore Project, are listed below.

Objective ALL 01: Maintain or restore lynx habitat connectivity in and between LAUs and in linkage areas.

Standard ALL S1: New or expanded permanent development and vegetation management projects must maintain habitat connectivity in a LAU and/or linkage area.

Guideline ALL G1: Methods to avoid or reduce effects on lynx should be used when constructing or reconstructing highways or forest highways across federal land. Methods could include fencing, underpasses, or overpasses.

Objective VEG O1: Manage vegetation (VEG) to mimic or approximate natural succession and disturbance processes while maintaining habitat components necessary for the conservation of lynx.

Objective VEG O2: Provide a mosaic of habitat conditions through time that support dense horizontal cover and high densities of snowshoe hare. Provide winter snowshoe hare habitat in both the stand initiation structural stage and in mature, multistory conifer vegetation.

Standard VEG S1: If more than 30 percent of the lynx habitat in a LAU is in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat, no additional habitat may be regenerated by vegetation management projects.

Standard VEG S2: Timber management projects will not regenerate more than 15 percent of lynx habitat on National Forest System lands within a LAU within a 10-year period.

Standard VEG S6: Vegetation management projects that reduce snowshoe hare habitat in multistory mature or late successional forests may occur only:

- Within 200 feet of administrative sites, dwellings, outbuildings, recreation sites, and special use permit improvements, including infrastructure within permitted ski area boundaries
- For research studies or genetic tests evaluating genetically improved reforestation stock
- For incidental removal during salvage harvest (*e.g.*, removal due to location of skid trails)
- Exceptions 2 and 3 will only be used in LAUs where standard VEG S1 is met

Timber harvest is allowed in areas that have potential to improve winter snowshoe hare habitat but presently have poorly developed understories that lack dense horizontal cover (*e.g.*, uneven aged management systems could be used to create openings where there is little understory so that new forage can grow).

Guideline VEG G5: Habitat for alternate prey species, primarily red squirrel, should be provided in each LAU.

Guideline VEG G11: Denning habitat should be distributed in each LAU in the form of pockets of large amounts of large woody debris, either down logs or root wads, or large piles of small wind-thrown trees ("jack-strawed" piles). If denning habitat appears to be lacking in the LAU, then projects should be designed to retain some down wood, piles, or residual trees to provide denning habitat in the future.

Objective HU O1: Maintain the lynx's natural competitive advantage over other predators in deep snow, by discouraging the expansion of snow-compacting activities in lynx habit.

Objective HU O3: Concentrate activities in existing developed areas rather than developing new areas in lynx habitat.

Objective HU O5: Manage human activities, such as special uses, mineral and oil and gas exploration and development, and placement of utility transmission corridors, to reduce impacts on lynx and lynx habitat.

Guideline HU G4: For mineral and energy development sites and facilities, remote monitoring should be encouraged to reduce snow compaction.

Guideline HU G5: For mineral and energy development sites and facilities that are closed, a reclamation plan that restores lynx habitat should be developed.

Guideline HU G6: Methods to avoid or reduce effects on lynx should be used in lynx habitat when upgrading unpaved roads to maintenance levels 4 or 5, if the result would be increased traffic speeds and volumes, or a foreseeable contribution to increases in human activity or development. Maintenance levels define the level of service provided by and maintenance required for a road (FSH 7709.58, Sec 12.3 – Transportation System Maintenance Handbook). Maintenance level 4 is assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double-lane and aggregate surfaced. Some may be single-lane, and some may be paved or have dust abated. Maintenance level 5 is assigned to roads that provide a high degree of user comfort and convenience. Normally roads are double-lane and paved, but some may be aggregate surfaced with the dust abated.

Guideline HU G7: New permanent roads should not be built on ridgetops, saddles, or in areas identified as important for lynx habitat connectivity. New permanent roads and trails should be situated away from forested stringers (*i.e.*, narrow bands of forest habitat).

Guideline HU G8: Cutting brush along low-speed, low-traffic-volume roads should be done to the minimum level necessary to provide for public safety.

Guideline HU G9: On new roads built for projects, public motorized use should be restricted. Effective closures should be provided in road designs. When the project is completed, these roads should be reclaimed or decommissioned, if not needed for other management objectives.

Guideline HU G12: Winter access for non-recreation special uses and mineral and energy exploration and development, should be limited to designated routes or designated over-the snow routes.

Analysis of Impacts to Lynx on Private and State Land

Impacts to lynx on private and state land from the transmission line alternatives were evaluated qualitatively, based on KNF lynx habitat mapping for potentially affected LAUs, mapping of broad vegetation types shown on Figure 83, tracking surveys, and hair sample analyses conducted by Western Resource Development (1989f) and FWP, and predicted changes in habitat and disturbance resulting from the transmission line alternatives.

3.24.5.4.2 Affected Environment

National lynx population and habitat status descriptions are described in Clark (2000), and are incorporated by reference. The KNF is within a core lynx area identified in the recovery outline for the contiguous United States distinct population segment of the Canada lynx (USFWS 2005), and provides 1,010,000 acres of occupied lynx habitat (USDA Forest Service 2007a). At the end of 2005, all but one LAU in the KNF (14104) met the LCAS habitat standards (≥10 percent denning habitat, ≤30 percent unsuitable condition, ≤15 percent changed to unsuitable condition in 10 years) (USDA Forest Service 2006d). Due to natural wildfire events, 32 percent of the lynx habitat in LAU 14104 was in unsuitable condition. The latter two LCAS standards are also applicable under the Lynx Amendment (USDA Forest Service 2007a). The analysis area is not within proposed lynx critical habitat (73 Fed. Reg. 10862 (February 28, 2008)).

Lynx habitat in the West Fisher and Crazy LAUs was estimated based on habitat parameters described in the Lynx Amendment (Figure 91). Most historical (prior to 1997) observations of lynx or their sign in the West Fisher LAU were in the Lake Creek or West Fisher Creek drainages, although three observations were recorded near Miller Creek. At least 20 lynx observations have been recorded in the Crazy LAU, near Howard Lake and in most of the major drainages including Libby, Ramsey, and Poorman creeks. Most records of lynx in the West Fisher and Crazy LAUs are from 1985 through 1995, and none have been recorded since 1997. Table 197 displays the current lynx habitat conditions in the PSU.

Table 197. Lynx Habitat on National Forest System Lands in the West Fisher and Crazy LAUs.

LAU	Total Lynx Habitat[1] In LAU	Unsuitable Habitat[2]	Habitat Changed to Unsuitable Over Past 10 Years by Timber Management with Regeneration Harvests[3]	Number of Adjacent LAUs that Exceed 30% Lynx Habitat in an Unsuitable Condition[4]
West Fisher (14503) (acres)	20,673	727 (4)	29 (<1)	0
Crazy (14504) (acres)	31,685	1,330 (4)	193 (<1)	0

Number in parentheses is percent of total lynx habitat in LAU.
LAU = Lynx Analysis Area.
[1] Lynx habitat: suitable plus unsuitable habitat. National Forest System land only.
[2] Unsuitable habitat: habitat that currently does not provide sufficient vegetation quantity or quality (height) to be used by snowshoe hare and lynx. Generally corresponds to "lynx habitat in a stand initiation structural stage that does not provide winter snowshoe hare habitat," as described in the Lynx Amendment (USFWS 2007c). No additional regeneration harvest allowed if more than 30 percent of lynx habitat in a LAU is in a stand initiation structural stage that does not provide winter snowshoe hare habitat.
[3] Source: USDA Forest Service 2003e. No more than 15 percent of lynx habitat on National Forest System lands in a LAU may be changed by regeneration harvest in a 10-year period.
[4] Source: USDA Forest Service 2007a.

All lynx habitat components are well represented and dispersed throughout both LAUs. Only 4 percent of LAU 14503 (727 acres) and LAU 14504 (1,330 acres) consist of unsuitable habitat,

and less than 1 percent of lynx habitat has been changed to unsuitable habitat in either LAU in 10 years. In addition, none of the adjacent LAUs have more than 30 percent of lynx habitat in an unsuitable condition.

The LCAS (Ruediger *et al.* 2000) defines key linkage areas as: "habitat that provides landscape connectivity between blocks of habitat. Linkage areas occur both within and between geographic areas, where blocks of lynx habitat are separated by intervening areas of non-habitat such as basins, valleys, agricultural lands, or where lynx habitat naturally narrows between blocks." A linkage area was identified between the northern and southern end of the Cabinet Mountains (KNF Lynx Taskforce 1997; USDA Forest Service 2004). Due to the distance from the proposed project, this linkage area would not be affected by the proposed project.

Connectivity between more extensive areas of lynx habitat may be provided by narrow forested mountain ridges, shrub-steppe plateaus, wooded riparian communities, or lower elevation ponderosa pine woodlands between high elevation spruce-fir forests (Ruediger *et al.* 2000). Within West Fisher and Crazy LAUs, and within the adjacent LAUs, a large tract of lynx habitat occurs along the CMW and movement corridors and habitat connectivity appear more than adequate to support movement and dispersal of lynx.

Research on the effects of roads and trails on lynx is inconclusive, although limited information suggests that lynx do not avoid roads (McKelvey *et al.* 2000) except at high traffic volumes (Apps 2000). Snow compaction on roads or trails may facilitate access of competing carnivores that would normally be limited by snow-depths into lynx habitat (Buskirk *et al.* 2000). However, in a study conducted in western Montana, Kolbe *et al.* (2007) found that the influence of snowmobile trails on coyote movements and foraging success appeared to be minimal. Open roads occur throughout the West Fisher and Crazy LAUs; existing roads most relevant to the Montanore Project include those in major drainages such as Poorman Creek, Ramsey Creek, Libby Creek, as well as the Bear Creek Road (NFS road #278) and Libby Creek Road (NFS road #231). Roads in the Ramsey Creek, Poorman Creek, and uppermost Libby Creek drainages are currently closed to motorized traffic except winter snowmobile traffic. The current status of roads potentially affected by the Montanore Project is described in Chapter 2.

Similarly, there is little information available on the effects of human disturbance on lynx. Based on mostly anecdotal evidence, lynx appear to be generally tolerant of humans (Ruediger *et al.* 2000). The effects of human activities on lynx activity patterns and energetics are unknown (ibid.).

Habitat for red squirrels, an alternative prey species for lynx, occurs primarily in older closed-canopy forests with substantial quantities of down wood. As described in section 3.24.2, *Key Habitats*, existing levels of down wood are greater than KNF-recommended levels. Most red squirrel habitat would occur within old growth forest, although some may not meet all the criteria for old growth. As described in section 3.21, *Vegetation*, old growth in the Crazy and Silverfish PSUs, which overlap to a great extent with West Fisher and Crazy LAUs, currently meets KNF standards.

About 24 percent of LAU 14503 and about 53 percent of LAU 14504 consists of denning habitat, and most of the stands in denning habitat are generally larger than 10 acres (Figure 91). Both of these LAUs meet the standards formerly established by the LCAS for denning habitat (greater than 10 percent denning habitat). In addition, as indicated in section 3.24.2, *Key Habitats*, snags

and down wood associated with lynx denning habitat appear to be greater than KFP-recommended levels. For the alternatives analysis, potential denning habitat is considered as multistory mature or late successional forest.

Canada lynx observation data indicate that sightings have been verified in both the West Fisher and Crazy LAUs. All lynx habitat within the influence area of the Montanore Project is within these two LAUs.

Small areas of private land within the alternative transmission line corridors in the West Fisher and Crazy LAUs provide lynx habitat, specifically a parcel of Plum Creek land along West Fisher Creek, a narrow parcel of private land southeast of Howard Lake, and a parcel of private land at the confluence of Libby and Howard creeks. Other private and state land within the West Fisher and Crazy LAUs are not mapped as lynx habitat. Although lynx may occasionally venture beyond the West Fisher and Crazy LAUs, private, state, and National Forest System land in the alternative transmission line corridors does not provide suitable lynx habitat because it is too low in elevation (less than 4,000 feet), has mostly been logged, and has high road densities.

3.24.5.4.3 Environmental Consequences

Impacts to lynx habitat from individual mine and transmission line alternatives are shown in Table 198 and Table 199. None of the mine alternatives would affect lynx in LAU 14503 (West Fisher). The impacts described for mine alternatives would be limited to LAU 14504 (Crazy). The analysis area is not within proposed critical habitat for lynx (73 Fed. Reg. 10862 (February 28, 2008)), and none of the mine or transmission line alternatives would affect proposed critical habitat for lynx.

Alternative 1 – No Mine

Alternative 1 would have no impacts on lynx or lynx habitat.

Alternative 2 – MMC's Proposed Mine

ALL 01 and ALL S1: Alternative 2 would not affect any designated linkage areas. None of the Alternative 2 activities would occur along ridgelines that might serve as lynx movement areas. In Alternative 2, construction of mine facilities could affect lynx movement within LAU 14504 by removing forest cover in potential movement areas such as the Little Cherry Creek, Ramsey Creek, and Upper Libby Creek riparian corridors. New disturbance would be primarily concentrated within specific areas of these drainages, such as for the plant, adit, and impoundment sites, while direct habitat loss or alteration along most of the length of these riparian corridors would be minimal. Although traffic would increase on some mine access roads, displacement effects from human activity, including low-traffic roads, do not appear to be a major concern for lynx (Ruediger *et al.* 2000). There is no evidence that lynx avoid or are displaced by unpaved roads; therefore, unpaved roads are not considered a threat to lynx movement (USFWS 2003c). In addition, in Alternative 2, traffic volumes on National Forest System roads are anticipated to remain relatively low (see section 3.20, *Transportation*). The proposed mine would generate an additional 132 vehicles per day greater than the existing traffic volumes for Bear Creek Road, which is 120 vehicles per day for 2007. Lynx movement across roads would probably not be impeded as a result of Alternative 2, and effects on lynx movement would be minor.

Effects to wetlands and riparian areas providing potential lynx movement corridors would be minimized through implementation of MMC's proposed Wetland Mitigation Plan (see 2.4.6.1,

Wetland Mitigation Plan). In addition, lynx habitat connectivity would be improved through acquisition of habitat acquired for grizzly bear mitigation for Alternative 2.

Table 198. Impacts to Lynx Habitat by Mine Alternative.

Habitat Component	[1] No Mine/ Existing Conditions	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Tailings Impoundment Alternative	[4] Agency Mitigated Little Cherry Creek Tailings Impoundment Alternative
West Fisher LAU (14503)				
LAU in Stand Initiation Structural Stage[1] (acres)	727 (4)	727 (4)	727 (4)	727 (4)
Regeneration Harvest in Lynx Habitat in the Last 10 Years[2] (acres)	29 (<1)	29 (<1)	29 (<1)	29 (<1)
Impacts to Multi-story Mature or Late Succession Forest Snowshoe Hare Habitat[3] (acres)	0 (0)	0 (0)	0 (0)	0 (0)
Crazy LAU (14504)				
LAU in Stand Initiation Structural Stage[1] (acres)	1,330 (4)	3,139 (10)	2,780 (9)	2,885 (9)
Regeneration Harvest in Lynx Habitat in the Last 10 Years[2] (acres)	193 (<1)	2,002 (4)	1,643 (3)	1,748 (4)
Impacts to Multi-story Mature or Late Succession Forest Snowshoe Hare Habitat[3] (acres)	0 (0)	391 (-2)	167 (-1)	306 (-2)

Number in parentheses is percent of all lynx habitat in LAU.
LAU = Lynx Analysis Area.
[1] Corresponds to "unsuitable" habitat as described in Ruediger *et al.* (2000). Standard: No additional regeneration harvest in stands where more than 30 percent of the lynx habitat in a LAU is in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat.
[2] Standard: Timber management projects will not regenerate more than 15 percent of lynx habitat on National Forest System lands within a LAU within a 10-year period.
[3] Based on mapping of lynx "denning" habitat as described in Ruediger *et al.* (2000).
Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 199. Impacts to Lynx Habitat by Transmission Line Alternative.

Measurement Criteria	[A] No Transmission Line/Existing Conditions	[B] MMC's Proposed Transmission Line (North Miller Creek Alternative)	[C] Modified North Miller Creek Transmission Line Alternative	[D] Miller Creek Transmission Line Alternative	[E] West Fisher Creek Transmission Line Alternative
West Fisher LAU (14503)					
LAU in Stand Initiation Structural Stage[1] (acres)	727 (4)	741 (4)	738 (4)	765 (4)	850 (4)
Regeneration Harvest in Lynx Habitat in the Last 10 Years[2] (acres)	29 (<1)	43 (<1)	40 (<1)	67 (<1)	152 (<1)
Impacts to Multi-story Mature or Late Succession Forest Snowshoe Hare Habitat[3] (acres)	0 (0)	6 (<-1)	6 (<-1)	0 (0)	5 (<-1)
Crazy LAU (14504)					
LAU in Stand Initiation Structural Stage[1] (acres)	1,330 (4)	1,433 (5)	1,398 (4)	1,400 (4)	1,400 (4)
Regeneration Harvest in Lynx Habitat in the Last 10 Years[2] (acres)	193 (<1)	296 (1)	261 (1)	263 (1)	263 (1)
Impacts to Multi-story Mature or Late Succession Forest Snowshoe Hare Habitat[3] (acres)	0 (0)	25 (<-1)	13 (<-1)	19 (<-1)	19 (<-1)

Number in parentheses is percent of all lynx habitat in LAU.
LAU = Lynx Analysis Area.
[1] Corresponds to "unsuitable" habitat as described in Ruediger *et al.* (2000). Standard: No additional regeneration harvest in stands where more than 30 percent of the lynx habitat in a LAU is in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat.
[2] Standard: Timber management projects will not regenerate more than 15 percent of lynx habitat on National Forest System lands within a LAU within a 10-year period.
[3] Based on mapping of lynx "denning" habitat as described in Ruediger *et al.* (2000).
Source: GIS analysis by ERO Resources Corp. using KNF data.

ALL G1: About 10 miles of the Bear Creek Road (NFS road #278), from U.S. 2 to the Bear Creek bridge, would be chip-and-seal paved and upgraded to applicable NFS road standards. The road would be widened to 20 to 29 feet wide and designed to handle speeds of 35 to 45 mph. Of the 10 miles of Bear Creek Road that would be reconstructed for Alternative 2, about 2.5 miles occurs in lynx habitat. About 7.5 miles of realigned and new road would be needed from the Bear Creek bridge to the Ramsey Plant Site, most of which would be in lynx habitat. A single-lane bridge over Poorman Creek would be constructed to accommodate mine traffic. Public access to any portion of Bear Creek Road would not be restricted. Public access to the new mine access road would be restricted to mine-related traffic.

Reconstructed and new roads associated with Alternative 2 do not incorporate specific measures to avoid or reduce effects on lynx. Roads improved for Alternative 2 would allow higher vehicle speeds and increased traffic, and could increase the risk of lynx mortality due to vehicle collision. Lynx mortality due to vehicle collisions may be prevented or reduced by installing wildlife crossing signs or reducing speed limits on roads used for Alternative 2. Traffic volumes on National Forest System roads are anticipated to remain relatively low (see section 3.20, *Transportation*). Specific road design measures that would minimize potential road reconstruction impacts to lynx are not necessary.

VEG 01, VEG 02, and VEG S1: At mine closure, disturbed habitat would be reclaimed, potentially becoming lynx habitat in the long term. As shown in Table 198, habitat in a stand initiation structural stage (*i.e.*, unsuitable condition) would increase from 4 to 9 percent of LAU 14504. In Alternative 2, lynx habitat would be well below the 30 percent standard. Alternative 2 would likely have minor effects on the distribution of lynx habitat components in LAU 14504.

VEG S2: In Alternative 2, about 2,002 acres of regeneration harvest, or 4 percent, would occur in lynx habitat in 10 years in LAU 14504 (Table 198). Alternative 2 would meet this standard.

VEG S6: About 391 acres of multistory or late-successional forest snowshoe hare habitat would be affected by Alternative 2 (Table 198). Alternative 2 would not meet this standard.

VEG G5 and G11: Impacts from Alternative 2 on old growth forest potentially providing red squirrel habitat are described in section 3.21, *Vegetation*. About 307 acres of old growth would be affected by Alternative 2 (Table 145). Compared to the other mine alternatives, Alternative 2 would affect the most old growth habitat, but its effects on the proportion of old growth in the analysis area would be minor. Land acquired for grizzly bear mitigation for Alternative 2 would likely provide additional habitat for lynx prey species. The effects of Alternative 2 on red squirrel habitat would likely be minor.

Alternative 2 would have minor effects on the proportion of multistory or mature late-successional forest associated with denning habitat in LAU 14504 (Table 198), and the standards formerly established by the LCAS for denning habitat (≥ 10 percent denning habitat) would be met. In addition, as indicated in section 3.24.2, *Key Habitats*, snags and down wood associated with lynx denning habitat appear to be greater than KFP-recommended levels.

Objectives HU 01, 03, and 05: Activities associated with Alternative 2 were designed to avoid lynx habitat and use existing roads and facilities (*i.e.*, the Libby Adit). No new snowmobile trails or play areas would be created in Alternative 2. The Ramsey Creek Road would be open yearlong to mine traffic only, but this road is currently open for administrative use and winter snowmobile use. Alternative 2 would not likely facilitate access of competing carnivores.

Guidelines HU G4 through G9 and G12: Alternative 2 includes several operational and post-operational monitoring plans (see section 2.4.5, *Operational and Post-Operational Monitoring Programs*). It would not be feasible to conduct monitoring remotely.

Alternative 2 includes a reclamation plan that over the long term would likely restore affected lynx habitat (see section 2.4.3, *Reclamation Phase*). The reclamation plan for Alternative 2 was developed with the goal of establishing a post-mining environment compatible with existing and proposed land uses, and consistent with the KFP. Disturbed areas would be recontoured where appropriate and revegetated with mostly native species. Tree and shrub seedlings would be planted in selected areas of the Ramsey Plant Site, the Libby Adit Site, and the Little Cherry Creek Tailings Impoundment Site. If reclamation were successful, disturbed areas would return to suitable lynx habitat in the long term.

As described for Guideline ALL G1 above, reconstructed and new roads associated with Alternative 2 do not incorporate specific methods to avoid or reduce effects on lynx. Alternative 2 would result in slight increases in traffic speeds and volume in LAU 14504, and could increase the risk of lynx mortality due to vehicle collisions. Lynx mortality due to vehicle collisions may be prevented or reduced by installing wildlife crossing signs or reducing speed limits on roads used for Alternative 2. Traffic volumes on KNF roads are anticipated to remain relatively low (see section 3.20, *Transportation*). Specific road design measures that would minimize potential road reconstruction impacts to lynx are probably not necessary.

All new roads associated with Alternative 2 except for the reconstructed segments of the Bear Creek Road would be gated and restricted to public access. All new roads would be decommissioned following mine closure. Winter road access for activities associated with Alternative 2 would be limited to designated routes. Alternative 2, as well as the other mine alternatives, would include plowing of the Bear Creek Road (NFS road #278), and the Libby Creek Road (NFS road #231) during the evaluation program and while the Bear Creek Road is reconstructed, which would make access to lynx habitat easier for trappers and increase the risk of incidental lynx mortality.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Impacts to lynx in LAU 14504 from Alternative 3 would be the same as Alternative 2, with the exception of the following.

ALL 01 and ALL S1: Impacts to wetlands and riparian areas would be minimized through implementation of the agencies' Wetland Mitigation Plan and Vegetation Removal and Disposition Plan (sections 2.5.7.1, *Wetland Mitigation* and 2.5.3.2.1, *Vegetation Removal and Disposition*), and the Environmental Specifications (Appendix D). Potential impacts to lynx movement within the LAU also would be minimized by concentrating disturbance from plant facilities and adits in Libby Creek.

VEG 01, VEG 02, and VEG S1: Although habitat in a stand initiation structural stage (*i.e.*, unsuitable condition) would increase from 4 to 9 percent of LAU 14504 (Table 198), lynx habitat would be well below the 30 percent standard threshold. Alternative 3 would likely have minor effects on the distribution of lynx habitat components in LAU 14504.

VEG S2: In Alternative 3, about 1,643 acres of regeneration harvest, or 3 percent of all lynx habitat in LAU 14504, would occur in lynx habitat in 10 years (Table 198). Alternative 3 would meet this standard.

VEG S6: About 167 acres of multistory or late-successional forest snowshoe hare habitat would be impacted by Alternative 3 in LAU 14504 (Table 198). Alternative 3 would not meet this standard.

VEG G5 and G11: Impacts from Alternative 3 on old growth forest potentially providing red squirrel habitat are described in section 3.21, *Vegetation*. About 183 acres of old growth would be impacted by Alternative 3, but the effects on the proportion of old growth in the analysis area would be small. Red squirrel habitat would continue to be available at close to existing levels in Alternative 3.

HU 01, 03, and 05: Activities associated with Alternative 3 were designed to avoid lynx habitat and use existing roads and facilities (*i.e.*, the Libby Adits and Upper Libby Adit). Potential impacts to lynx movement within the LAU also would be minimized by concentrating disturbance from plant facilities and adits in the Libby Creek drainage.

For Alternative 3, disturbed areas would be reseeded with native species only, except in specific situations as approved by lead agencies. Also, reclamation success criteria and planting/seeding conditions would be more rigorous, and tree planting densities would be greater in Alternative 3 than Alternative 2. These modifications in the reclamation plan would likely result in more rapid revegetation of lynx habitat.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts to lynx in LAU 14504 from Alternative 4 would be the same as Alternative 3, with the exception of the following.

VEG S2: In Alternative 4, about 1,748 acres of regeneration harvest, or 6 percent, would occur in lynx habitat in LAU 14504 in 10 years (Table 198). Alternative 4 would meet this standard.

VEG S6: About 306 acres of multistory or late-successional forest snowshoe hare habitat would be impacted by Alternative 4 (Table 198). Alternative 4 would not meet this standard.

VEG G5 and G11: Impacts from Alternative 4 on old growth forest potentially providing red squirrel habitat are described in section 3.21, *Vegetation*. About 175 acres of old growth would be impacted by Alternative 4, but the effects on the proportion of old growth in the analysis area would be small. Red squirrel habitat would continue to be available at close to existing levels in Alternative 4.

Alternative A – No Transmission Line

Alternative A would not affect the lynx or lynx habitat.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Effects on Lynx on National Forest System Lands

ALL 01 and ALL S1: Alternative B would not affect any designated linkage areas.

In Alternative B, construction of the transmission line and access roads could affect lynx movement within LAUs 14503 and 14504 by removing forest cover in potential movement areas such as the Miller, Howard, Libby, and Ramsey creek corridors. Vegetation would be cleared in areas of ground disturbance, such as access roads and pulling and tensioning sites. In some portions of transmission line clearing areas, only the tallest trees would be removed, leaving some shrub and tree cover in the transmission line right-of-way. Portions of the clearing area would not require clearing, such as high spans across valleys. Areas of surface disturbance in lynx habitat would return to suitable lynx habitat in the long term. The greatest regeneration harvest would occur with Alternative B, compared to the other transmission line alternatives. Regeneration harvest would occur on up to 14 acres of lynx habitat in LAU 14503, and up to 103 acres of lynx habitat in LAU 14504. Displacement effects from human activity, including low-traffic roads, do not appear to be a major concern for lynx (Ruediger *et al.* 2000). Construction activities and transmission line access roads would probably not affect lynx movement within LAUs 14503 and 14504.

Implementation of MMC's proposed Wetland Mitigation Plan (see section 2.4.6.1, *Wetland Mitigation Plan*) and the Environmental Specifications (Appendix D) would promote connectivity by increasing availability of continuous forest or shrub cover. In addition, lynx habitat connectivity would be improved through acquisition of habitat acquired for grizzly bear mitigation. Land acquired for grizzly bear mitigation that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity. Land acquired to mitigate the effects of Alternative B would potentially improve lynx habitat connectivity, if it were managed to provide lynx habitat.

ALL G1: Reconstructed and new roads associated with Alternative B do not incorporate specific measures to avoid or reduce effects on lynx. Alternative B would include the construction of new roads and reconstruction of existing roads for transmission line access. Use of most of these roads would be limited to construction equipment during the construction period, and traffic volumes would be low. Specific measures that would minimize potential impacts to lynx are not necessary.

VEG 01, VEG 02, and VEG S1: Following construction, land within the right-of-way that has been rutted, compacted, or disturbed would be reclaimed. After the transmission line has been built, roads opened or constructed for transmission line access would be gated or barriered and regraded, scarified, and reseeded as an interim reclamation activity designed to stabilize the surface. After the transmission line was removed, all newly constructed roads would be bladed and recontoured to match existing topography, obliterating the road prism. Disturbed habitat would potentially return to suitable lynx habitat in the long term. As shown in Table 199, although habitat in a stand initiation structural stage (*i.e.*, unsuitable condition) would increase from 4 to 5 percent of LAU 14504, lynx habitat would be well below the 30 percent standard threshold. Impacts from Alternative B in LAU 14503 would not change the proportion of habitat in a stand initiation structural stage (*i.e.*, unsuitable condition). Alternative B would likely have minor effects on the distribution of lynx habitat components in either LAU.

VEG S2: In Alternative B, about 43 acres and 296 acres of regeneration harvest would occur in lynx habitat in 10 years in LAUs 14503 and 14504, respectively. The effects of Alternative B on the proportion of regeneration harvest in lynx habitat in 10 years would be minor. Alternative B would meet this standard.

VEG S6: Alternative B would affect about 6 acres of multistory or late-successional forest snowshoe hare habitat in LAU 14503, and 25 acres in LAU 14504. Alternative B would not meet this standard. Compared to other transmission line alternatives, impacts on multistory or late-successional forest snowshoe hare habitat would be the greatest for Alternative B.

VEG G5 and G11: Impacts from Alternative B on old growth forest potentially providing red squirrel habitat are described in section 3.21, *Vegetation*. About 23 acres of old growth would be affected by Alternative B. Compared to the other transmission line alternatives, Alternative B would affect the most old growth habitat, but its effects on the proportion of old growth in the analysis area would be minor. Land acquired for grizzly bear mitigation that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity. Land acquired to mitigate the effects of Alternative B would potentially provide additional habitat for lynx prey species, if it was managed to provide lynx habitat. The impacts of Alternative B on red squirrel habitat would likely be minor.

Alternative B would have minor effects on the overall proportion of multistory or mature late-successional forest associated with denning habitat in LAUs 14503 and 14504 (Table 199), and the standards formerly established by the LCAS for denning habitat (≥10 percent denning habitat) would be met. As indicated in section 3.24.2, *Key Habitats*, snags and down wood associated with lynx denning habitat appear to be greater than KFP-recommended levels in the analysis area. Some shrub and tree cover would be maintained in the transmission line right-of-way; only the largest trees would be removed and some areas would not be cleared, providing down wood important for lynx denning.

HU 01, 03, and 05: No new snowmobile trails or play areas would be created in Alternative B. Components of Alternative B were designed, to the extent possible, to avoid lynx habitat and use existing roads and facilities. Where possible, roads currently open year-round would be used for construction access. Although some new access roads would be built, and some currently closed roads would be opened for transmission line access, these roads would be used temporarily during transmission line construction and would not likely be used during winter.

HU G4 through G9 and G12: Alternative B includes several operational and post-operational monitoring plans (see section 2.5.5, *Reclamation Phase*). It would not be feasible to conduct monitoring remotely.

Alternative B includes a reclamation plan that over the long term would likely restore affected lynx habitat (see section 2.8.3, Operation, Maintenance, and Reclamation). The reclamation plan for Alternative B was developed with the goal of establishing a post-mining environment compatible with existing and proposed land uses and consistent with the KFP. Following construction, land within the right-of-way that has been rutted, compacted, or disturbed would be reclaimed. Access roads opened or constructed for transmission line access would be gated or barriered and regraded, scarified, and reseeded after transmission line construction. At mine closure, the transmission line would be removed and all new roads would be recontoured and reclaimed, obliterating the road prism. Native shrubs, such as alder or willow, would be planted on streambanks to reduce bank erosion.

As described for Guideline ALL G1 above, reconstructed and new roads associated with Alternative B do not incorporate specific methods to avoid or reduce effects on lynx. Traffic volumes on KNF roads are anticipated to remain relatively low (see section 3.20, *Transportation*).

Specific measures that would minimize potential road reconstruction impacts to lynx are probably not necessary.

Winter road access for activities associated with Alternative B would be limited to designated routes. Access roads opened or constructed for transmission line access would be used only during the construction phase or for maintenance, which is expected to be required infrequently, and would not likely be used during winter. Annual inspections and most transmission line maintenance would be completed via helicopter or non-motorized access.

Effects on Lynx on Private and State Land

Alternative B would affect about 1 acre of land in LAUs 14504 and 14503, which provide lynx habitat at the confluence of Libby and Howard creeks. Effects to lynx on other private lands would be minimal because those lands do not provide suitable lynx habitat. Effects to lynx habitat would be reduced through acquisition of habitat acquired for grizzly bear mitigation. Land acquired for grizzly bear mitigation that might otherwise be developed in a manner inconsistent with bear needs, would be managed for grizzly bear use in perpetuity. Land acquired to mitigate the effects of Alternative B would potentially improve lynx habitat, if managed to provide lynx habitat.

Alternative C – Modified North Miller Creek Transmission Line Alternative

Effects on Lynx on National Forest System Lands

Impacts to lynx in LAU 14504 from Alternative C would be the same as Alternative B, with the exception of the following:

ALL 01 and ALL S1: More right-of-way and tree clearing, but fewer structures and access roads, would be required for Alternative C than Alternative B. In Alternative C, construction of the transmission line and access roads could affect lynx movement within LAUs 14503 and 14504 by removing forest cover in potential movement areas such as the Miller Creek and Howard Creek riparian corridors. Regeneration harvest would occur on up to 11 acres of lynx habitat in LAU 14503, and up to 68 acres of lynx habitat in LAU 14504. The least regeneration harvest would occur with Alternative C, compared to the other transmission line alternatives. These acreages are probably an overestimate of the actual effects because a Vegetation Removal and Disposition Plan developed for Alternative C (section 2.5.3.2.1, *Vegetation Removal and Disposition*) would minimize tree clearing, thereby maintaining more shrub and tree cover in the transmission line right-of-way than Alternative B. Slash would be left in the right-of-way, providing down wood important for lynx denning. Areas of surface disturbance in lynx habitat, such as access roads and pulling and tensioning sites, would return to suitable lynx habitat in the long term if reclamation were successful.

Implementation of the agencies' Wetland Mitigation Plan (section 2.5.7.1, *Wetland Mitigation*), Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*), and the Environmental Specifications (Appendix D) would promote connectivity by increasing availability of continuous forest or shrub cover. In addition, lynx habitat connectivity would be improved through acquisition of habitat acquired for grizzly bear mitigation. Land acquired for grizzly bear mitigation that might otherwise be developed in a manner inconsistent with bear needs, would be managed for grizzly bear use in perpetuity. Land acquired to mitigate the effects of Alternative C would potentially improve lynx habitat connectivity, if it were managed to provide lynx habitat.

VEG 01, VEG 02, and VEG S1: As shown in Table 199, the percent of habitat in LAUs 14503 and 14504 in a stand initiation structural stage (*i.e.*, unsuitable condition) would not change in Alternative C. Alternative C would likely have minor effects on the distribution of lynx habitat components in either LAU.

VEG S2: In Alternative C, about 40 acres and 261 acres of regeneration harvest would occur in lynx habitat in 10 years in LAUs 14503 and 14504, respectively (Table 199). These calculations are probably an overestimate of the actual effects because a Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*) developed for the agencies' alternatives would minimize tree clearing. The effects of Alternative C on the proportion of regeneration harvest in lynx habitat in 10 years would be minor. Alternative C would meet this standard.

VEG S6: Impacts from Alternative C on multistory or late-successional forest snowshoe hare habitat would consist of about 6 acres in LAU 14503 and 13 acres in LAU 14504 (Table 199). Alternative C would not meet this standard. Implementation of the Vegetation Removal and Disposition Plan developed for Alternative C (section 2.5.3.2.1, *Vegetation Removal and Disposition*) would minimize these impacts. Slash would be left in the right-of-way, providing down wood important for lynx denning. Compared to other transmission line alternatives, impacts on multistory or late-successional forest snowshoe hare habitat would be the least for Alternative C and Alternative D.

VEG G5 and G11: Impacts from Alternative C on old growth forest potentially providing red squirrel habitat are described in section 3.21, *Vegetation*. About 8 acres of old growth would be impacted by Alternative C. Compared to the other transmission line alternatives, Alternative C would affect the least old growth habitat, and its effects on the proportion of old growth in the analysis area would be minor. Land acquired for grizzly bear mitigation that might otherwise be developed in a manner inconsistent with bear needs, would be managed for grizzly bear use in perpetuity. Land acquired to mitigate the effects of Alternative C would potentially provide additional habitat for lynx prey species, if it were managed to provide lynx habitat. Red squirrel habitat would continue to be available at close to existing levels in Alternative C.

Alternative C would have minor effects on the overall proportion of multistory or mature late-successional forest associated with denning habitat in LAUs 14503 and 14504 (Table 199), and the standards formerly established by the LCAS for denning habitat (≥10 percent denning habitat) would be met. As indicated in section 3.24.2, *Key Habitats*, snags and down wood associated with lynx denning habitat appear to be better than KFP-recommended levels in the analysis area. Some shrub and tree cover would be maintained in the transmission line right-of-way, and areas would not be cleared, providing coarse down wood important for lynx denning. Also, slash and large logs would be left in the right-of-way, providing down wood important for lynx denning.

HU 01, 03, and 05: No new snowmobile trails or play areas would be created in Alternative C. Components of Alternative C were designed, to the extent possible, to avoid lynx habitat and use existing roads and facilities. Fewer structures and access roads would be required for Alternative C than Alternative B. For Alternative C, helicopters would be used to construct structures at 20 locations in the Miller Creek, Midas Creek, and Howard Creek drainages, thereby eliminating the need for access roads in these locations.

Effects on Lynx on Private and State Land

Alternative C would affect about 1 acre of private land in LAUs 14504 and 14503, which provide lynx habitat at the confluence of Libby and Howard creeks. Impacts to lynx on other private lands would be minimal because they do not provide suitable lynx habitat. Effects of mitigation would be the same as Alternative B.

Alternative D – Miller Creek Transmission Line Alternative

Effects on Lynx on National Forest System Lands

Impacts to lynx in LAU 14504 from Alternative D would be the same as Alternative C, except the following.

In Alternative D, construction of the transmission line and access roads could affect lynx movement within LAUs 14503 and 14504 by removing forest cover in potential movement areas such as the Miller Creek and Howard Creek corridors. Regeneration harvest would occur on 67 acres of lynx habitat in LAU 14503, and 263 acres of lynx habitat in LAU 14504.

VEG S2: In Alternative D, about 67 acres and 263 acres of regeneration harvest would occur in lynx habitat in 10 years in LAUs 14503 and 14504, respectively (Table 199). These acreages are probably an overestimate of the actual effects because a Vegetation Removal and Disposition Plan developed for agencies' alternatives (section 2.5.3.2.1, *Vegetation Removal and Disposition*) would minimize tree clearing. The effects of Alternative D on the proportion of regeneration harvest in lynx habitat in 10 years would be minor. Alternative D would meet this standard.

VEG S6: No multistory or late-successional forest snowshoe hare habitat would be affected by Alternative D in LAU 14503. Impacts from Alternative D on multistory or late-successional forest snowshoe hare habitat would consist of about 19 acres in LAU 14504 (Table 199). Alternative D would not meet this standard. Implementation of the Vegetation Removal and Disposition Plan developed for Alternative D (section 2.5.3.2.1, *Vegetation Removal and Disposition*) would minimize these impacts. Compared to other transmission line alternatives, Alternative C and Alternative D would have the least effect on multistory or late-successional forest snowshoe hare habitat.

VEG G5 and G11: Impacts from Alternative D on old growth forest potentially providing red squirrel habitat are described in section 3.21, *Vegetation*. About 13 acres of old growth would be impacted by Alternative D. Compared to the other transmission line alternatives, Alternative D would affect the least old growth habitat, and its effects on the proportion of old growth in the analysis area would be minor.

HU 01, 03, and 05: For Alternative D, helicopters would be used to construct structures at 21 locations in the Miller Creek and Howard Creek drainages, thereby eliminating the need for access roads in these locations.

Effects on Lynx on Private and State Land

Effects on lynx on private land in LAUs 14504 and 14503 would be the same for Alternative D as Alternative C. Alternative D would affect about 4 acres of a narrow parcel of private land southeast of Howard Lake mapped as unsuitable lynx habitat.

Alternative E – West Fisher Creek Transmission Line Alternative

Effects on Lynx on National Forest System Lands

Impacts to lynx in LAU 14504 from Alternative E would be the same as Alternative C, with the exception of the following.

VEG S2: In Alternative E, about 152 acres and 263 acres of regeneration harvest would occur in lynx habitat in 10 years in LAUs 14503 and 14504, respectively (Table 199). These acreages are probably an overestimate of the actual effects because a Vegetation Removal and Disposition Plan developed for the agencies' alternatives (section 2.5.3.2.1, *Vegetation Removal and Disposition*) would minimize tree clearing. The effects of Alternative E on the proportion of regeneration harvest in lynx habitat in 10 years would be minor. Alternative E would meet this standard.

VEG S6: Impacts from Alternative E on multistory or late-successional forest snowshoe hare habitat would consist of about 5 acres in LAU 14503 and 19 acres in LAU 14504 (Table 199). Alternative E does not meet this standard. Implementation of the Vegetation Removal and Disposition Plan developed for Alternative E (section 2.5.3.2.1, *Vegetation Removal and Disposition*) would minimize these impacts.

VEG G5 and G11: Impacts from Alternative E on old growth forest potentially providing red squirrel habitat are described in section 3.21, *Vegetation*. About 13 acres of old growth would be impacted by Alternative E. Compared to the other transmission line alternatives, Alternative E would affect the least old growth habitat, and the effects on the proportion of old growth in the analysis area would be minor.

HU 01, 03, and 05: For Alternative E, helicopters would be used to construct structures at 21 locations along West Fisher Creek, thereby eliminating the need for access roads in these locations.

Effects on Lynx on Private and State Land

Alternative E would affect about 30 acres of land in LAUs 14504 and 14503 providing lynx habitat on a parcel of Plum Creek land along West Fisher Creek. Alternative E would affect about 4 acres of a narrow parcel of private land southeast of Howard Lake mapped as unsuitable lynx habitat. Effects to lynx on other private lands would be minimal because those lands do not provide suitable lynx habitat.

Combined Mine-Transmission Line Effects

Impacts to lynx habitat from combined mine-transmission line alternatives are shown below in Table 200 and summarized in the following paragraphs.

Effects on Lynx on National Forest System Lands

The No Action Alternative would not affect lynx or their habitat. The mine alternatives would not affect lynx in LAU 14503. Impacts in LAU 14503 are due entirely to the effects of the transmission line.

ALL 01 and ALL S1: None of the combined mine-transmission line alternatives would affect any designated linkage areas.

Table 200. Impacts to Lynx Habitat by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] No Mine/ Existing Conditions	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Cherry Creek Impoundment Area		
	TL-A	TL-B	TL-C	TL-D	TL-E	TL-C	TL-D	TL-E
West Fisher LAU (14503)								
LAU in Stand Initiation Structural Stage[1] (acres)	727 (4)	741 (4)	738 (4)	765 (4)	850 (4)	738 (4)	765 (4)	850 (4)
Regeneration Harvest in Lynx Habitat in the Last 10 Years[2] (acres)	29 (<1)	43 (<1)	40 (<1)	67 (<1)	152 (<1)	40 (<1)	67 (<1)	152 (<1)
Impacts to Multi-story Mature or Late Succession Forest Snowshoe Hare Habitat[3] (acres)	0 (0)	6 (<-1)	6 (<-1)	0 (0)	5 (<-1)	6 (<-1)	0 (0)	5 (<-1)
Crazy LAU (14504)								
LAU in Stand Initiation Structural Stage[1] (acres)	1,330 (4)	3,228 (10)	2,896 (9)	2,895 (9)	2,895 (9)	3,064 (10)	2,997 (9)	2,997 (9)
Regeneration Harvest in Lynx Habitat in the Last 10 Years[2] (acres)	193 (<1)	2,088 (7)	1,708 (5)	1,710 (5)	1,710 (5)	1,874 (6)	1,814 (6)	1,814 (6)
Impacts to Multi-story Mature or Late Succession Forest Snowshoe Hare Habitat[3] (acres)	0 (0)	425 (-3)	186 (-1)	193 (-1)	193 (-1)	345 (-2)	335 (-2)	335 (-2)

Number in parentheses is percent of all lynx habitat in LAU.
LAU = Lynx Analysis Area.
[1] Corresponds to "unsuitable" habitat as described in Ruediger *et al.* (2000). Standard: No additional regeneration harvest in stands where more than 30 percent of the lynx habitat in a LAU is in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat.
[2] Standard: Timber management projects will not regenerate more than 15 percent of lynx habitat on National Forest System lands within a LAU within a 10-year period.
[3] Based on mapping of "denning" habitat as described in Ruediger *et al.* (2000).
Source: GIS analysis by ERO Resources Corp. using KNF data.

In all combined action alternatives, construction of the transmission line and access roads could affect lynx movement within LAUs 14503 and 14504 by removing forest cover in potential movement areas in the Miller, Howard, Libby, West Fisher, and Ramsey creek corridors. Vegetation would be cleared in areas of ground disturbance, such as access roads and pulling and tensioning sites. In some portions of transmission line clearing areas only the largest trees would be removed, leaving some shrub and tree cover in the transmission line right-of-way. Portions of the clearing area would not require clearing, such as high spans across valleys. Areas of surface disturbance in lynx habitat could be restored to suitable lynx habitat in the long term if natural successional processes were permitted to occur. Displacement effects from human activity, including low-traffic roads, do not appear to be a major concern for lynx (Ruediger *et al.* 2000). Construction activities and transmission line access roads would probably not affect lynx movement within LAUs 14503 and 14504.

Implementation of MMC's proposed Wetland Mitigation Plan (see section 2.4.6.1, *Wetland Mitigation Plan*), the agencies' Wetland Mitigation Plan (section 2.5.7.1, *Wetland Mitigation*), Vegetation Removal and Disposition Plan (section 2.5.3.2.1, *Vegetation Removal and Disposition*), and the Environmental Specifications (Appendix D) would promote connectivity by increasing availability of continuous forest or shrub cover. In addition, lynx habitat connectivity would be improved through acquisition of habitat acquired for grizzly bear mitigation. Land acquired for grizzly bear mitigation that might otherwise be developed in a manner inconsistent with bear needs, would be managed for grizzly bear use in perpetuity. Land acquired to mitigate the effects of the combined action alternatives would potentially improve lynx habitat connectivity, if it were managed to provide lynx habitat.

ALL G1: Reconstructed and new roads associated with all combined action alternatives do not incorporate specific measures to avoid or reduce effects on lynx. All combined action alternatives would include the construction of new roads and reconstruction of existing roads for transmission line access. Use of most of these roads would be limited to construction equipment during the construction period, and traffic volumes would be low. Specific measures that would minimize potential impacts to lynx are not necessary.

VEG 01, VEG 02, and VEG S1: In all combined action alternatives, following construction, land within the right-of-way that has been rutted, compacted, or disturbed would be reclaimed. After the transmission line has been built, roads opened or constructed for transmission line access would be gated or barriered and regraded, scarified, and reseeded as an interim reclamation activity designed to stabilize the surface. After the transmission line was removed, all newly constructed roads would be bladed and recontoured to match existing topography, obliterating the road prism. Disturbed habitat would potentially return to suitable lynx habitat in the long term. As shown in Table 200, habitat in a stand initiation structural stage (*i.e.*, unsuitable condition) in LAU 14504 would increase by 6 percent for Alternatives 2B and 4C, and by 5 percent in all other combined action alternatives. However, habitat in a stand initiation structural stage would be less than the 30 percent standard. None of the combined action alternatives would change the proportion of habitat in a stand initiation structural stage (*i.e.*, unsuitable condition) in LAU 14503. All combined action alternatives would likely have minor effects on the distribution of lynx habitat components in either LAU.

VEG S2: All combined action alternatives would increase regeneration harvest occurring in lynx habitat in 10 years in LAUs 14503 and 14504, but the proportion of regeneration harvest in lynx habitat in 10 years would be less than the 10 percent standard.

VEG S6: All combined action alternatives would affect multistory or late-successional forest snowshoe hare habitat. Impacts to multistory or late-successional forest snowshoe hare habitat in LAU 14503 would be between 5 and 6 acres for all combined action alternatives except Alternatives 3D and 4D, which would not affect multistory or late-successional forest snowshoe hare habitat in LAU 14503. Impacts to multistory or late-successional forest snowshoe hare habitat in LAU 14504 would be between 186 and 193 acres for Alternatives 3C, 3D, 3E; between 335 and 345 acres for Alternatives 4C, 4D, and 4E; and 425 acres for Alternative 2B. None of the combined action alternatives would meet this standard.

VEG G5 and G11: As described in section 3.21, *Vegetation*, all combined action alternatives would affect old growth forest potentially providing red squirrel habitat. Impacts to old growth would range from 185 acres for Alternatives 4C and 4E to 325 acres for Alternative 2B, but the effects on the proportion of old growth in the analysis area would be minor. Land acquired for grizzly bear mitigation that might otherwise be developed in a manner inconsistent with bear needs, would be managed for grizzly bear use in perpetuity. Land acquired to mitigate the effects of the combined action alternatives would potentially provide additional habitat for lynx prey species, if it were managed to provide lynx habitat. The impacts of the combined action alternatives on red squirrel habitat would likely be minor.

All combined action alternatives would have minor effects on the overall proportion of multistory or mature late-successional forest associated with denning habitat in LAUs 14503 and 14504 (Table 200), and the standards formerly established by the LCAS for denning habitat (≥10 percent denning habitat) would be met in all combined mine-transmission line alternatives.

HU 01, 03, and 05: No new snowmobile trails or play areas would be created for any of the combined mine-transmission line alternatives. Components of combined action alternatives were designed, to the extent possible, to avoid lynx habitat and to use existing roads and facilities. Where possible, roads currently open year-round would be used for construction access. Although some new access roads would be built and some currently closed roads would be opened for transmission line access, these roads would be used temporarily during transmission line construction and would not likely be used during winter.

HU G4 through G9 and G12: Combined action alternatives include several operational and post-operational monitoring plans (see sections 2.5.6, *Operational and Post-Operational Monitoring Programs* and 2.6.6, *Mitigation Plans*). It would not be feasible to conduct monitoring remotely.

All combined action alternatives include a reclamation plan that over the long term would return disturbed lynx habitat to pre-project quality. Reclamation plans have been discussed previously.

As described for Guideline ALL G1 above, reconstructed and new roads associated with the combined action alternatives do not incorporate specific methods to avoid or reduce effects on lynx. Traffic volumes on KNF roads are anticipated to remain relatively low (see section 3.20, *Transportation*). Specific measures that would minimize potential road reconstruction impacts to lynx are probably not necessary.

Winter road access for activities associated with the combined action alternatives would be limited to designated routes. Access roads opened or constructed for transmission line access would be used only during the construction phase or for maintenance, which is expected to be required infrequently, and would not likely be used during winter. Annual inspections and most transmission line maintenance would be completed via helicopter or non-motorized access. However, all combined

action alternatives would include plowing of the Bear Creek Road (NFS road # 278), and the Libby Creek Road (NFS road #231) during the evaluation program and while the Bear Creek Road is reconstructed, which would make access to lynx habitat easier for trappers and increase the risk of incidental lynx mortality.

Tranmission Line Effects on Lynx on Private and State Land

Impacts of the combined action alternatives to lynx habitat on private lands in LAUs 14504 and 14503 would occur at the following locations:

- All combined action alternatives would affect 22 acres of suitable lynx habitat from development of the Libby Adit
- Alternatives 2B, 3C, 3D, 4C, and 4D would affect about 1 acre of suitable lynx habitat at the confluence of Libby and Howard creeks
- Alternatives 3D, 3E, 4D, and 4E would affect about 4 acres of unsuitable lynx habitat southeast of Howard Lake
- Alternative 4E would affect about 30 acres of lynx habitat on a parcel of Plum Creek land along West Fisher Creek

Other private and state land potentially affected by the combined action alternatives within LAUs 14503 and 14504 are not mapped as lynx habitat. Impacts to lynx on private and state lands outside of LAUs 14503 and 14504 would be minimal because they do not provide suitable lynx habitat.

Cumulative Effects

Effects on Lynx on National Forest System Lands

Neither Alternative 1 nor Alternative A would have cumulative impacts on lynx. The mine action alternatives would not have any impacts to lynx in LAU 14503, and would not contribute to cumulative impacts in this LAU.

Basic road maintenance, pre-commercial thinning, mushroom picking, prescribed burning, timber hauling, wildlife habitat improvement projects and various recreational uses have occurred and would continue to occur within the analysis area. These activities are generally not considered to have adverse impacts on wildlife species. These activities may incidentally affect wildlife use within some areas on a temporary basis, but would not likely affect the viability of lynx.

ALL 01 and ALL S1: None of the combined mine-transmission line alternatives would contribute to cumulative impacts to any designated linkage areas. Cumulative effects of both mine and transmission line alternatives, in combination with other ongoing or reasonably foreseeable actions, on lynx movement within LAU 14504 would be minor. Lynx movement does not appear to be affected by low-traffic roads, and areas of reduced cover would be small relative to surrounding habitat. The combined effects of the removal of forest cover in potential movement areas associated with the combined action alternatives and the Miller-West Fisher Vegetation Management Project could result in cumulative effects to lynx movement in LAU 14503.

ALL G1: All combined action alternatives, in combination with reasonably foreseeable actions, would result in slight increases in traffic speeds and volume in LAUs 14503 and 14504, thereby increasing the risk of lynx mortality due to vehicle collisions. For the transmission line alternatives, cumulative traffic increases would occur primarily during the construction period and would be short-

term. Cumulative traffic increases for the mine alternatives would be long-term and would last through the reclamation phase. Vehicle collisions could be prevented or reduced by installing wildlife crossing signs or reducing speed limits on roads used for the Montanore Project. Cumulative traffic volumes are anticipated to be low (see section 3.20, *Transportation*). Specific measures that would minimize potential impacts to lynx would not be necessary for any of the action alternatives.

VEG 01, VEG 02, and VEG S1: Habitat in a stand initiation structural stage (*i.e.*, unsuitable condition) would remain less than 10 percent for combined mine-transmission line alternatives. The combined mine-transmission line alternatives, in combination with other ongoing or reasonably foreseeable actions, would not likely exceed the 30 percent standard.

VEG S2: Regeneration occurring in 10 years would remain less than 7 percent in LAUs 14503 and 14504 in all combined mine-transmission line alternatives. The combined mine-transmission line alternatives, in combination with other ongoing or reasonably foreseeable actions, would not likely exceed the 15 percent standard.

VEG S6: All combined action alternatives, in combination with other ongoing or reasonably foreseeable actions, would affect multistory or late-successional forest snowshoe hare habitat. The Miller-West Fisher Vegetation Management Project would include regeneration harvest of about 475 acres, slash treatment of 681 acres, and prescribed burning of 3,751 acres of National Forest System lands in the Silverfish PSU, which encompasses LAU 14503. It is not possible to quantify the effects on multistory or late-successional forest snowshoe hare habitat from other reasonably foreseeable projects, but the Miller-West Fisher and road access projects in particular are likely to add to impacts to multistory or late-successional forest snowshoe hare habitat.

VEG G5 and G11: The combined mine-transmission line alternatives, in combination with the Miller-West Fisher Vegetation Management Project would maintain the designated management level of old growth (see section 3.21, *Vegetation*). It is likely that the designated management level of old growth would continue to be maintained despite the cumulative effects of the combined action alternatives and ongoing or reasonably foreseeable actions. Thus, the action alternatives would not likely substantially reduce red squirrel habitat in LAU 14503 or 14504.

In all combined action alternatives, denning habitat would be at least 14 and 40 percent greater in LAUs 14503 and 14504, respectively, than the standard formerly established by the LCAS for denning habitat (≥ 10 percent denning habitat). This standard would likely be met when the effects of other ongoing or reasonably foreseeable actions are included. Also, activities associated with the Miller-West Fisher Vegetation Management Project are expected to retain down wood within KFP guideline levels for the Silverfish PSU, and while prescribed burns associated with the Miller-West Fisher Vegetation Management Project would consume some down wood, it also would create down wood by killing live trees. Down wood created in burned areas would provide lynx denning habitat and habitat for alternative prey species such as red squirrels. Cumulative impacts from the action alternatives would not likely cause a shortage of snags and down wood associated with lynx denning habitat, given the current levels.

HU 01, 03, and 05: New winter road use would be minimal for the mine alternatives, and would be limited to a few new access roads within permit boundaries. Transmission line access roads would rarely be used during the winter. All combined action alternatives would include plowing of the Bear Creek Road (NFS road #278), and the Libby Creek Road (NFS road #231) during the evaluation program and while the Bear Creek Road is reconstructed, which would make access to lynx habitat

easier for trappers and increase the risk of incidental lynx mortality. Minor levels of additional winter road use could occur for other ongoing and reasonably foreseeable actions. Cumulatively, expansion of snow-compacting activities and increased winter access for trappers is expected to be minimal in all action alternatives.

In all combined action alternatives, traffic volumes and speeds may cumulatively be greater in the Miller Creek and West Fisher Creek drainages and near main access roads (see section 3.20, *Transportation*), resulting in an increased risk of lynx mortality from vehicle collisions. Cumulative traffic increases in LAU 14503 would occur primarily during transmission line construction and would be short-term. Cumulative traffic increases from the mine alternatives in LAU 14504 would be long-term and would last through the reclamation phase, although traffic increases would be lower during reclamation than operations. Vehicle collisions could be prevented or reduced by installing wildlife crossing signs or reducing speed limits on roads used for the Montanore Project. Cumulative traffic volumes are not anticipated to be high enough to warrant incorporation of specific road design measures to minimize potential impacts to lynx.

Tranmission Line Effects on Lynx on Private and State Land

The combined action alternatives, in combination with reasonably foreseeable actions, could result in a cumulative increase in temporary housing facilities developed on private lands, potentially resulting in cumulative impacts to lynx habitat in LAUs 14504 and 14503. Also, as discussed in section 3.17, *Social/Economics*, many areas of private land are being converted from timber or agricultural production and open space use into residential subdivisions and ranchettes. Development of private land would likely occur primarily outside of LAUs 14504 and 14503, but some could occur within suitable lynx habitat in those LAUs. Impacts of the combined action alternatives, in combination with increased development of private land, could result in cumulative losses of lynx habitat on private land, but these losses would probably be minor, given the likely extent of impacts and quality of habitat potentially impacted.

3.24.5.4.4 Regulatory/Forest Plan Consistency

KFP. All of the combined mine-transmission line alternatives comply with KFP direction on threatened and endangered species that applies to the lynx (KFP Vol. 1, II-1 #7 and II-22).

Endangered Species Act. For all alternatives, ESA compliance would be ensured through Section 7 consultation. The KNF will submit a BA to the USFWS that describes the potential effect on threatened and endangered species that may be present in the area. After review of the BA and consultation, the USFWS will issue a biological opinion (BO) for the proposed Montanore Project.

Statement of Findings. All of the combined action alternatives would likely adversely affect the Canada lynx because they would affect multistory or late-successional forest snowshoe hare habitat. None of the combined mine-transmission line alternatives would likely result in the destruction or adverse modification of proposed critical habitat.

3.24.5.5 Irreversible and Irretrievable Commitments

No irreversible commitments of resources due to impacts on the Canada lynx or their habitat would occur as a result of any of the action alternatives.

Due to the length of the proposed activity (25 to 30 years), the loss of available habitat, and reduced habitat effectiveness, the habitat carrying capacity for grizzly bear would be reduced in all combined

action alternatives. This effect may be irreversible should the loss of habitat keep the population potential below a viable level. If the population stays below the viable level, the effect becomes irretrievable without large scale augmentation. Even with reclamation of the tailings impoundment and other areas disturbed by the project, the disturbed areas could have less habitat effectiveness than currently exists, based on a high probability of reduced species diversity. This habitat loss could reduce the carrying capacity to the point that a viable population of grizzly bears could not be supported.

Irretrievable commitments of resources would occur as a result of impacts to lynx from the combined action alternatives, including the loss of multistory or late-successional forest snowshoe hare habitat and non-compliance with standard VEG S6. The combined action alternatives also would result in an increase in unsuitable lynx habitat and the loss of old growth forest potentially providing red squirrel habitat.

3.24.5.6 Short-term Uses and Long-term Productivity

For the mine alternatives, impacts to the grizzly bear, including the loss of available habitat and reduced habitat effectiveness, would last until mine reclamation was completed. New openings in forest cover would remain in the long term, but could return to their former condition after a considerable period of time. For the transmission line alternatives, most of the impacts to grizzly bear would subside once the transmission line and substation were built, until decommissioning. Short-term impacts to grizzly bear from the transmission line include a reduction in forest cover and an increase in open grass or shrub fields.

Long-term losses of lynx habitat would occur in all combined action alternatives, including the loss of multistory or late-successional forest snowshoe hare habitat. Although small relative to the amount of existing habitat, the greatest habitat losses would occur at the impoundment sites, followed by the plant and adit sites. If reclamation were successful, areas of disturbed lynx habitat could potentially be restored to suitable lynx habitat, but only after a considerable length of time. New roads constructed for transmission line access would be redisturbed during removal of the transmission line at reclamation. Although redisturbed transmission line access roads would be revegetated, recovery of lynx habitat would be prolonged in redisturbed areas.

3.24.5.7 Unavoidable Adverse Environmental Effects

Unavoidable adverse effects would occur to the grizzly bear due to the construction of new roads, the opening of closed roads, and mine and transmission line construction activities and operations. Unavoidable impacts to lynx would occur due to losses or alteration of lynx habitat from the construction of mine and transmission line facilities.

3.24.6 Migratory Birds

3.24.6.1 Regulatory Framework

Migratory birds, including raptors, their eggs, and any active nests, are protected under the MBTA. The MBTA stipulates that it is unlawful to destroy an active migratory bird nest, nestling, or eggs. For most migratory bird species, the active nesting season is generally April through August.

Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, requires analysis of effects of federal actions on migratory birds as part of the environmental analysis process.

On January 17, 2001, the USDA Forest Service and the USFWS signed an MOU to implement the Executive Order.

Under NFMA guidelines, Forest Plans shall "provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives…" (16 USC 1604(g)(3)(B)). Additional direction states that "management prescriptions, where appropriate and to the extent practicable, shall preserve and enhance the diversity of plant and animal communities, including endemic and desirable naturalized plant and animal species, so that it is at least as great as that which could be expected in a natural forest." Furthermore, implementation regulations for the NFMA specify that, "fish and wildlife habitat shall be managed to maintain diverse populations of existing native and desired non-native vertebrate species in the planning area."

The MFSA directs DEQ to approve a facility if, in conjunction with other findings, DEQ finds and determines that the facility minimizes adverse environmental impacts, considering the state of available technology and the nature and economics of all of the alternatives. An assessment of effects on birds is part of the transmission line certification process.

3.24.6.2 Analysis Area and Methods

Information regarding species occurrence comes from District wildlife observation records, and KNF historical data, MNHP, and the results of bird surveys conducted in 1989 and 2005 (Western Resource Development 1989f; Westech 2005a). Impacts to migratory birds are evaluated based on alternative effects on habitat associated with bird communities observed, as described in section 3.21, *Vegetation*; MIS species representing specific habitats; bird species discussed in section 3.24.4, *Forest-Sensitive Species*; and mortality risks. The analysis area for project impacts and cumulative effects to individuals and their habitat consists of the Crazy and Silverfish PSUs and any non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments. The analysis area for cumulative effects is the KNF and any non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments.

3.24.6.3 Affected Environment

In Montana, most non-grouse (Order *Gallinaceous*) birds, except for European starling, house sparrow, and rock dove (pigeon), are protected under the MBTA, even though species such as the great horned owl tend to be present throughout the year. Most migratory birds are species that migrate to more northerly latitudes to breed during the summer. By the fall, these species migrate south to spend the winter months. Of the 205 bird species known to occur on the KNF, about 70 species could be classified as neotropical migratory land birds, or birds that migrate annually to and from the tropics in Mexico or Latin America.

The area surveyed by Western Resource Development (1989f) and Westech (2005a) included the permit areas and road corridors for Alternative 2, and the transmission line corridor for Alternative B. A complete list of birds observed during existing studies of the analysis area are provided in Western Resource Development (1989f) and Westech (2005a). Similar species were recorded during both studies. Species observed were expected for the particular habitats surveyed. Western Resource Development (1989f) found that the number of bird species was greatest in riparian habitat, followed by shrubfield habitat. Studies conducted by Westech (2005a) yielded somewhat different results; the number of species observed was greatest in shrubfield habitat. Differences between the two studies in

the number of species observed were likely due to differences in sampling methods and intensity (Westech 2005a).

Sections 3.24.4, *Forest-Sensitive Species* and 3.24.7, *Other Species of Interest* include a description of existing conditions for the black-backed woodpecker, flammulated owl, and goshawk. MIS species represent the habitat needs for migratory birds in general forest, old growth, and alpine habitat. As habitat for MIS species is being maintained, it is assumed that sufficient habitat and populations of migratory birds is also being maintained. Existing conditions for birds breeding in general forest, alpine, and old growth habitats are described for the white-tailed deer, elk, mountain goat, and pileated woodpecker in section 3.24.3, *Management Indicator Species*.

3.24.6.4 Environmental Consequences

3.24.6.4.1 Alternative 1 – No Mine

Alternative 1 would have no impacts on migratory birds.

3.24.6.4.2 Alternative 2 – MMC's Proposed Mine

Based on impacts described in section 3.21, *Vegetation*, birds associated with coniferous forest would be the most affected by Alternative 2, followed by birds associated with previously harvested coniferous forest. About 72 acres of riparian and wetland areas providing potential habitat for birds would be affected by Alternative 2. All wetlands affected would be replaced with wetlands with similar functions and values. Alternative 2 would affect more coniferous forest community, regeneration harvest community, and riparian areas than the other alternatives. At mine closure, disturbed habitat would be reclaimed, and habitat would potentially be restored to pre-mine conditions in the long term. For forested habitat, this would probably take decades or even centuries.

Impacts of Alternative 2 on the black-backed woodpecker, flammulated owl, and northern goshawk are described in sections 3.24.4, *Forest-Sensitive Species* and 3.24.7, *Other Species of Interest*. Alternative 2 impacts on general forest, alpine, and old growth habitats providing potential habitat for breeding birds are described for the white-tailed deer, elk, mountain goat, and pileated woodpecker in section 3.24.3, *Management Indicator Species*.

Response of migratory birds to timber harvest would depend upon their individual habitat preferences and needs. Clearing for mine facilities would remove forest habitat used by some species (*e.g.*, brown creeper, golden-crowned kinglet, Townsend's warbler, and Swainson's thrush) and shrub field habitat used by other species (*e.g.*, orange-crowned warbler, yellow warbler, and spotted towhee). Mine disturbance areas would likely provide little or no habitat for migratory birds. In addition, clearing would eliminate old growth habitat and snags, reducing densities of migratory birds dependent on those habitat features. While Alternative 2 would result in localized impacts to birds associated with forest and shrub field habitats, it would not result in widespread changes in bird communities on the KNF.

Vegetation clearing and earth moving during construction of Alternative 2 facilities could result in the destruction of active nests or eggs, or nest abandonment, if conducted during the migratory bird breeding season.

3.24.6.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Impacts to migratory birds from Alternative 3 would be the similar to Alternative 2, except that birds associated with previously coniferous forest would be the most affected by Alternative 3, followed by

birds associated with coniferous forest. Alternative 3 would affect less riparian and wetland areas providing potential habitat for birds (about 5 acres). All wetlands affected would be replaced with wetlands with similar functions and values. In comparison to Alternative 2, Alternative 3 would result in 571 fewer acres of habitat loss because the tailings impoundment would be smaller and the plant site would be located in the same drainage as the adits (Table 141). Also, as described in the agencies' Wildlife Mitigation Plan (section 2.5.7.3, *Wildlife Mitigation*), Alternative 3 includes timing restrictions and pre-construction nest surveys for black-backed woodpeckers, flammulated owls, and northern goshawks that would minimize the risk of nest destruction or abandonment for these species. If an active nest were found in the project vicinity, tree removal would not occur in an avoidance area appropriate for the species. These measures would reduce potential impacts to both migratory and non-migratory birds.

3.24.6.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts to migratory birds from Alternative 4 would be similar to Alternative 2, except that less coniferous forest and more previously harvest coniferous forest would be affected. Alternative 4 would affect less riparian and wetland areas providing potential habitat for birds (about 58 acres). In comparison to Alternative 2, Alternative 4 would result in 328 fewer acres of habitat loss because the plant site would be located in the same drainage as the adits (Table 141). Implementation of the agencies' Wildlife Mitigation Plan (section 2.5.7.3, *Wildlife Mitigation*) would be the same as Alternative 3, and would similarly reduce potential impacts to both migratory and non-migratory birds.

3.24.6.4.5 Alternative A – No Transmission Line

Alternative A would have no impacts on migratory bird habitat.

3.24.6.4.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Based on impacts described in section 3.21, *Vegetation*, Alternative B would affect the smallest amount of vegetation providing bird habitat compared to the other transmission line alternatives because of a narrower tree clearing width (150 feet compared to 200 feet) (Figure 83). As described in section 3.21, *Vegetation*, although more new roads would be built for Alternative B than other transmission line alternatives, direct impacts of road construction on vegetation communities would be relatively minor. Total disturbance from roads associated with Alternative B would be 14 acres. Birds associated with coniferous forest would be most affected by Alternative B, followed by birds associated with regeneration harvest areas. The transmission line clearing area would include about 13 acres of riparian and wetland areas providing potential habitat for birds. Direct effects to wetlands are expected to be mostly avoided by locating transmission line facilities and roads outside of wetlands and waters of the U.S. Alternative B would affect more coniferous forest community, regeneration harvest community, and riparian areas than the other alternatives. At the end of operations, disturbed habitat would be revegetated. Roads would be redisturbed for transmission line decommissioning and reclaimed after transmission line removal. After reclamation, disturbed habitat would potentially be restored to pre-transmission line conditions in the long term. For forested habitat, this would take probably take decades or even centuries.

Impacts of Alternative B on the bald eagle, black-backed woodpecker, flammulated owl, and northern goshawk are described in sections 3.24.4, *Forest-Sensitive Species* and 3.24.7, *Other Species of Interest*. Alternative B impacts on general forest, alpine, and old growth habitats providing potential habitat for breeding birds are described for the white-tailed deer, elk, mountain goat, and pileated woodpecker in section 3.24.3, *Management Indicator Species*.

Response of migratory birds to timber harvest depends upon their individual habitat preferences and needs. Clearing of forested areas for the transmission line would remove forest habitat used by some species (*e.g.*, brown creeper, golden-crowned kinglet, Townsend's warbler, and Swainson's thrush) and create grassland and shrubland habitat used by other bird species (*e.g.*, American kestrel, calliope hummingbird, and chipping sparrow). Clearing also would create edge habitat used by birds such as the dark-eyed junco, red-tailed hawk, and great-horned owl. While Alternative B would result in localized changes in species composition, it would not result in widespread changes in bird communities on the KNF.

Vegetation clearing and earth moving during construction of the transmission line could result in the destruction of active nests or eggs if conducted during the migratory bird breeding season. The Environmental Specifications (Appendix D) include timing restrictions and pre-construction nest surveys for bald eagles, black-backed woodpeckers, flammulated owls, and northern goshawks; implementation of these measures would minimize the risk of nest destruction or abandonment for these species.

The likelihood of the 230-kV transmission line resulting in the electrocution of migratory species including raptors is extremely low; electrocution is primarily a problem associated with lower-voltage distribution lines (APLIC 2006). Electrocutions potentially caused by the transmission line would be minimized through implementation of recommendations outlined in APLIC (2006), which are based on a minimum spacing of 60 inches between phases or between phase and ground wires, and the Environmental Specifications (Appendix D).

The proximity of the Alternative B transmission line to the Fisher River could increase the risk of bird collisions with the transmission line. Potential collisions of migratory birds with the transmission line would be reduced by constructing the transmission line according to recommendations outlined in APLIC (1994) and in compliance with the Environmental Specifications (Appendix D). Applicable recommendations include locating the transmission line away from streams, mountain passes, and other potential flight corridors; placement of the lines below treeline or other topographical features; and installation of line marking devices. The latter recommendation would be particularly relevant where the transmission line crossed the Fisher River.

3.24.6.4.7 Alternative C – Modified North Miller Creek Transmission Line Alternative

Impacts to migratory birds from Alternative C would be similar to Alternative B, except that more habitat would be disturbed due to a wider clearing width, and the transmission line clearing area would include less riparian and wetland areas that provide potential habitat for birds (about 5 acres). Also, the risk of bird collisions with the transmission line would be less for Alternative C because it also would be from the Fisher River corridor. In addition, as specified in section 2.9.4, *Wildlife Mitigation Measures*, areas of high risk for bird collisions where line marking devices may be needed (*i.e.*, major drainage crossings) and recommendations for the type of marking device would be identified through a study conducted by a qualified biologist and funded by MMC. The Environmental Specifications (Appendix D) include timing restrictions and pre-construction nest surveys for bald eagles, black-backed woodpeckers, flammulated owls, and northern goshawks; implementation of these measures would minimize the risk of nest destruction or abandonment for these species.

3.24.6.4.8 Alternative D – Miller Creek Transmission Line Alternative

Impacts to migratory birds from Alternative D would be similar to Alternative C, except that more habitat would be disturbed due to the longer length of Alternative D, and the transmission line

clearing area would include more riparian and wetland areas providing potential habitat for birds (about 14 acres). The Environmental Specifications (Appendix D) include timing restrictions and pre-construction nest surveys for bald eagles, black-backed woodpeckers, flammulated owls, and northern goshawks; implementation of these measures would minimize the risk of nest destruction or abandonment for these species.

3.24.6.4.9 Alternative E – West Fisher Creek Transmission Line Alternative

Impacts to migratory birds from Alternative E would be similar to Alternatives C and D, except that more habitat would be disturbed due to the longer length of Alternative E. The transmission line clearing area in Alternative E would include more riparian and wetland areas (about 29 acres) providing potential habitat for birds than Alternative C (about 5 acres), and Alternative D (about 14 acres). The Environmental Specifications (Appendix D) include timing restrictions and pre-construction nest surveys for bald eagles, black-backed woodpeckers, flammulated owls, and northern goshawks; implementation of these measures would minimize the risk of nest destruction or abandonment for these species.

3.24.6.4.10 Combined Mine-Transmission Line Effects

Impacts to vegetation communities providing potential migratory bird habitat for combined mine and transmission line alternatives are shown in Table 201 and described below.

Table 201. Impacts to Potential Migratory Bird Habitat by Combined Mine-Transmission Line Alternative.

Vegetation Community	[1] No Mine Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Cherry Creek Impoundment Area		
	TL-A	TL-B	TL-C	TL-D	TL-E	TL-C	TL-D	TL-E
Coniferous Forest (acres)	0	1,709	1,139	1,152	1,091	1,262	1,275	1,214
Previously Harvested Coniferous Forest (acres)	0	1,054	1,190	1,184	1,244	1,257	1,251	1,311
Wetland/Riparian (acres)	0	84	10	19	34	63	72	87

Source: GIS analysis by ERO Resources Corp. using KNF data and vegetation mapping in Westech 2005d and MMI 2005b.

Based on vegetation community impacts (Table 201), Alternative 2B would have the greatest impacts on birds associated with coniferous forest, affecting 1,709 acres. Birds associated with previously harvested coniferous forest would be most affected by Alternatives 3E, 4C, 4D, and 4E. Impacts to riparian and wetland areas providing potential habitat for birds would range from 10 acres for Alternative 3C to 87 acres for Alternative 4E. At mine closure, disturbed habitat would be reclaimed, and habitat would potentially be restored to pre-mine conditions in the long term. For forested habitat such as old growth, this could take centuries. At the end of operations, disturbed habitat would be revegetated. Roads would be redisturbed for transmission line decommissioning and reclaimed after transmission line removal. After reclamation, disturbed habitat would potentially be restored to pre-transmission line conditions in the long term.

Response of migratory birds to timber harvest depends upon their individual habitat preferences and needs. Clearing of forested areas for mine facilities and transmission lines would remove forest cover used by some species (*e.g.*, brown creeper, golden-crowned kinglet, and hermit thrush) and create grassland and shrubland habitat used by other bird species (*e.g.*, American kestrel, calliope hummingbird, and chipping sparrow). Clearing also would create edge habitat used by birds such as the dark-eyed junco, western tanager, and Townsend's warbler. While all combined action alternatives would result in localized changes in species composition, they would not result in widespread changes in bird communities on the KNF.

Impacts of the combined action alternatives on the bald eagle black-backed woodpecker, flammulated owl, and northern goshawk are described in sections 3.24.4, *Forest-Sensitive Species* and 3.24.7, *Other Species of Interest*. Combined action alternatives impacts on general forest, alpine, and old growth habitats providing potential habitat for breeding birds are described for the white-tailed deer, elk, mountain goat, and pileated woodpecker in section 3.24.3, *Management Indicator Species*.

In all combined action alternatives, as specified in the Environmental Specifications (Appendix D) and the agencies' Wildlife Mitigation Plan (sections 2.5.7.3, *Wildlife Mitigation* and 2.9.4, *Wildlife Mitigation Measures*), either tree removal would not occur during the breeding season for bald eagles, black-backed woodpeckers, flammulated owls, and northern goshawks, or surveys would be conducted in potential habitat for these species prior to project construction to identify potentially impacted nests. If an active nest were found in the project vicinity, tree removal would not occur in an avoidance area appropriate for the species until young have fledged. These measures would minimize potential impacts to nesting bald eagles, black-backed woodpeckers, flammulated owls, and northern goshawks. Alternative 2B does not include timing restrictions or sensitive species surveys of the mine disturbance area.

3.24.6.4.11 Cumulative Effects

Cumulative impacts of the action alternatives on the bald eagle, black-backed woodpecker, flammulated owl, and northern goshawk are described in sections 3.24.4, *Forest-Sensitive Species* and 3.24.7, *Other Species of Interest*. Cumulative impacts of the combined mine-transmission line alternatives impacts on general forest, alpine, and old growth habitats providing potential habitat for breeding birds are described for the white-tailed deer, elk, mountain goat, and pileated woodpecker in section 3.24.3, *Management Indicator Species*.

The transmission line alternatives, in combination with other reasonably foreseeable actions, would result in cumulative changes in species composition resulting from the conversion of forests to an early successional stage or to grasslands and shrubland. These cumulative habitat changes would favor migratory birds associated with grassland or shrubland habitats, and could contribute to a shift in species composition on the KNF.

3.24.6.4.12 Regulatory/Forest Plan Consistency

There are no specific goals or standards for migratory land birds in the KFP. One of the goals in the KFP is to: "maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species (KFP, Vol. 1, II-1 #7)." All action alternatives are consistent with the KFP because a wide range of successional habitats would be available (see sections 3.21, *Vegetation* and 3.24.3, *Management Indicator Species*). The action alternatives are in compliance with Executive Order 13186. In addition, because habitat for MIS species is being maintained in the Crazy and Silverfish PSUs and across the KNF, their habitat contributes to the maintenance of habitat and populations of neotropical migratory bird species.

3.24.6.5 Irreversible and Irretrievable Commitments

All action alternatives would result in an irreversible commitment of old growth and cavity habitat provided by snags and down wood in the analysis area. Re-establishment of old growth communities could take centuries.

All action alternatives would result in the loss of or disturbance to habitat supporting migratory birds. Following successful reclamation, with the exception of old growth communities, most disturbed habitats and their associated bird communities would eventually be restored to pre-mine or pre-transmission line conditions.

3.24.6.6 Short-term Uses and Long-term Productivity

Disturbed areas would be reclaimed at the end of mine operations or transmission line operations. If reclamation were successful, most habitats affected by the action alternatives would return to pre-mine or pre-transmission line conditions after several decades. Once habitat was restored, associated bird communities would likely return.

3.24.6.7 Unavoidable Adverse Environmental Effects

Unavoidable adverse environmental effects would occur where vegetation was cleared for mine facilities, roads, or the transmission line.

3.24.7 Other Species of Interest

3.24.7.1 Regulatory Framework

The KFP (KFP Vol. 1, II-1 # 3 and #7, II-7; and II-22-23) provides guidance for moose management concerning motorized access and maintenance of old growth and other age classes of vegetation.

Under NFMA guidelines, Forest Plans shall "provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives…" (16 USC 1604(g)(3)(B)). Additional direction states that "management prescriptions, where appropriate and to the extent practicable, shall preserve and enhance the diversity of plant and animal communities, including endemic and desirable naturalized plant and animal species, so that it is at least as great as that which could be expected in a natural forest."

The MFSA directs DEQ to approve a facility if, in conjunction with other findings, DEQ finds and determines that the facility minimizes adverse environmental impact, considering the state of available technology and the nature and economics of the alternatives. An assessment of effects on moose winter range and state species of concern is part of the transmission line certification process. In addition, FWP has also expressed concerns about potential impacts of the Montanore Project on moose.

3.24.7.2 Moose

3.24.7.2.1 Analysis Area and Methods

The analysis area for evaluating direct and indirect project impacts to individual moose and their habitat in the KNF is the Crazy and Silverfish PSUs (Figure 92). The analysis areas for determining direct, indirect, and cumulative effects on moose are the FWP moose HD number 105 and the KNF, respectively. To evaluate potential direct and indirect impacts of the transmission line on moose on private and state land, the analysis area includes all non-National Forest System land within a corridor

1 mile on each side of the alternative transmission line alignments. The Crazy and Silverfish PSUs and any land within a corridor 1 mile on each side of the alternative transmission line alignments is the analysis area for cumulative effects on moose.

Moose occurrence data come from District wildlife observation records, Forest historical data (NRIS FAUNA), and other agencies (MNHP, FWP). Moose winter range was derived from FWP and Western Resource Development (1989f) mapping and modified based on KNF and FWP biologists' knowledge of moose habitat use. Because their habitat requirements are similar, the same criteria used to evaluate project impacts on elk in the KNF were used for moose, with the following exceptions:

- Direct impacts to mapped moose winter range were calculated
- Cover to forage ratios were calculated for moose winter range, based on the mapping described above
- The recommended cover-to-forage ratio in moose winter range is 50 percent cover to 50 percent forage habitat
- The recommended proportion of cover in MAs 15, 16, and 17 is 30 percent, which is the same as white-tailed deer (MA designations, goals, and standards are described in detail in section 3.14.3.2.2, *Management Area Goals and Standards*)
- Similar to white-tailed deer, the number of openings greater than 20 acres was evaluated
- Movement areas evaluated were the same as white-tailed deer

MMC's proposed Alternatives 2 and B include an access change in NFS road #4724 from April 1 to June 30 and the yearlong access change in a segment of NFS road #4784 to mitigate for impacts to grizzly bears. NFS road #4784 is proposed for an access change by the Rock Creek Project, and is no longer available for Montanore Mine mitigation. The agencies' alternatives would include yearlong access changes, through the installation of barriers or gates, for several roads to mitigate for the loss of big game security and impacts to grizzly bear. These road access changes are taken into account in ORD, habitat effectiveness and security calculations. Additional road access changes also would occur on land acquired as part of the grizzly bear mitigation proposed by MMC and the agencies. ORD calculations do not take into account the effect of land acquisition programs proposed by MMC and the agencies described in the respective mitigation plans in sections 2.4.6.3, *Grizzly Bear Mitigation Plan* and 2.5.7.3, *Wildlife Mitigation*. Other mitigation measures incorporated into MMC's or the agencies' alternatives that could benefit moose include construction timing restrictions in moose winter habitat, prohibiting employees from carrying firearms, busing employees to the work site, and monitoring road-killed animals along mine access roads to determine if improved access resulted in increased wildlife mortality.

Impacts to moose on private and state land from the transmission line corridor were evaluated based on FWP-derived winter habitat mapping (Figure 92); security habitat generated from KNF roads data; FWP hunting and population data, research, and plans; KNF and FWP information on wildlife linkage areas; and mapping of broad vegetation types shown on Figure 83.

3.24.7.2.2 Affected Environment

The moose is a large ungulate that occupies mountain meadows, river valleys, swampy areas, and clearcuts in the summer; and willow flats or mature coniferous forests in the winter. Due to their large size and long limbs, moose negotiate deep snow better than other ungulates. Conifer stands composed

of uneven-aged classes and willows are important components of cover for moose (FWP and MNHP 2007).

Moose use riparian habitat throughout the year along the various creeks in the analysis area. They also use drier mid-elevation areas during summer. Their food consists primarily of shrubs, with some forbs during summer. In the analysis area, moose concentrate along riparian areas, in 15- to 20-year-old clearcuts with shrubby understories, in shrubfields, and in forested areas with shrubby understories. Moose prefer to live well up the Libby Creek and Ramsey creek drainages, as well as the other drainages along the east face of the Cabinet Mountains. They move out of these areas to the east and down the drainages only when forced to do so by increasing snowpack. They return to the upper portions of these drainages as early in the late winter/early spring as snow hardness allows. During some years, they remain high in the drainages into late January and early February. Moose could be expected to occupy areas around proposed impoundment and plant sites for 8 to 10 months of the year, depending on winter severity (Brown, pers. comm. 2008).

The area near Little Cherry Creek and Bear Creek is a very productive moose calving area in HD 105 (Williams, pers. comm. 2006). During late fall and winter, moose concentrate along Little Cherry Creek, Poorman Creek, Ramsey Creek, Miller Creek, West Fisher Creek, and on Big Hoodoo Mountain and west-facing slopes above the Fisher River (Figure 92) (Brown, pers. comm. 2008).

HD 105 is one of seven hunting districts in Region 1 selected by FWP for long-term moose population trend monitoring, based on its importance to moose. A standard "trend route" along the east slope of the Cabinet Mountains in HD 105 is surveyed annually to collect moose population composition and trend monitoring data (FWP 2007b). Trends in population, size, and composition are evaluated based on total moose, calf/cow ratios, and bull/cow ratios observed during trend area surveys. Harvest data and hunter effort data for HD 105 are also taken into consideration in the evaluation of population trends (Brown, pers. comm. 2008). Based on trend area data collected since 1990 and harvest data collected since 1984, the moose population in HD 105 showed a decline in overall numbers and recruitment in the mid-1990s. Since that time, moose populations in HD 105 have generally been increasing, although numbers of moose observed during 2007 surveys were lower than average (FWP 2007c). Results of the 2007 surveys could have been affected by poor weather conditions. During moose surveys of HD 105 conducted in December 2007, moose were observed in the highest concentrations on south- and west-facing slopes of the Little Hoodoo and Big Hoodoo mountains in the Big Cherry Creek and Bear Creek drainages, and on west-facing slopes of the Libby Creek drainage near Horse Mountain (ibid.).

As described for elk in section 3.24.3, *Management Indicator Species*, a wildlife linkage zone has been identified in the Fisher River Valley between the Barren Peak and Teeters Peak areas to the west of U.S. 2, and the Kenelty Mountain and Fritz Mountain areas to the east of U.S. 2 (see KNF project records). U.S. 2 in the Fisher River Valley between Raven and Brulee creeks is a crossing area for moose moving between the Cabinet Mountains and the Salish Mountains (Brown, pers. comm. 2008).

3.24.7.2.3 Environmental Consequences

Impacts to moose winter range and percent cover in moose winter range in the Crazy and Silverfish PSUs are shown in Table 202 and Table 203 and described in the following subsections. None of the mine alternatives would affect moose in the Silverfish PSU. Impacts on percent cover in summer range and MAs 15, 16, and 17; movement areas; road densities; percent security habitat, habitat effectiveness, and the creation of new openings would be the same as white-tailed deer in the Crazy PSU, and the same as elk in the Silverfish PSU. Impacts to white-tailed deer and elk are described in

section 3.24.3, *Management Indicator Species*. Habitat effectiveness and security were not determined for elk in the Crazy PSU, but are shown in Table 205 for combined mine-transmission line alternatives.

Table 202. Impacts to Moose Winter Range in the Crazy PSU by Mine Alternative.

Habitat Component	[1] No Mine/ Existing Conditions	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Tailings Impoundment Alternative	[4] Agency Mitigated Little Cherry Creek Tailings Impoundment Alternative
Moose Winter Range Impacted (acres)	0	2,417	1,904	2,079
Cover in Winter Range Impacted (acres)	0	2,011	1,710	1,702
Percent Cover/Forage Moose Winter Range[1]	90/10 (50/50)	80/20	82/18	82/18

Values in parentheses represent standards.
[1] Percent forage habitat is likely underestimated because moose will forage in shrubfields that may be mapped as cover.
Source: GIS analysis by ERO Resources Corp. using KNF data and moose winter range derived from FWP and Western Resource Development 1989f mapping as modified based on KNF and FWP biologists' knowledge of moose habitat use.

Alternative 1 – No Mine

Alternative 1 would have no impacts on moose or their habitat.

Alternative 2 – MMC's Proposed Mine

Alternative 2 would result in the disturbance of 2,417 acres of moose winter habitat, mostly as a result of the tailings impoundment and the LAD Areas (Table 202). This loss of habitat also would include key calving habitat. Cover to forage ratios would shift due to clearing of cover, but cleared areas would not provide forage habitat until after they were reclaimed. Alternative 2 would likely result in the displacement of moose to adjacent winter range and calving sites. Moose may occupy a home range of a few hundred acres during the winter, and certain individuals could be completely or partially displaced from their traditional wintering sites. If moose populations in surrounding areas subsequently exceed carrying capacity as a result of this habitat loss, the moose population may be adversely affected. Widening, improvement, and yearlong access of the Bear Creek Road could lead to increased vehicle volumes and speed, which could increase the risk of moose mortality from vehicle collisions. Impacts to moose winter range would be at least partially minimized through MMC's proposed land acquisition program. Acquired parcels would be managed for grizzly bear use in perpetuity, and could improve or contribute suitable moose winter habitat if the acquired parcels potentially provided winter range characteristics and were managed to improve winter moose habitat through road access changes or other means.

Table 203. Impacts to Moose Winter Range in the Analysis Area by Transmission Line Alternative.

Habitat Component	[A] No Transmission Line/ Existing Conditions	[B] MMC's Proposed Transmission Line (North Miller Creek Alternative)	[C] Modified North Miller Creek Transmission Line Alternative	[D] Miller Creek Transmission Line Alternative	[E] West Fisher Creek Transmission Line Alternative
Crazy PSU					
Cover in Winter Range Impacted (acres)	0	41	29	15	15
Percent Cover/Forage Moose Winter Range[1]	90/10 (50/50)	80/10	80/10	80/10	80/10
Silverfish PSU					
Cover in Winter Range Impacted (acres)	0	60	76	71	100
Percent Cover/Forage Moose Winter Range[1]	97/3 (50/50)	97/3	97/3	97/3	96/4
All Lands in Analysis Area					
Moose Winter Range Impacted (acres)	0	146	165	168	210

Numbers in parentheses are standards.
[1] Percent forage habitat is likely underestimated because moose will forage in shrubfields that may be mapped as cover.
Source: GIS analysis by ERO Resources Corp. using KNF data and moose winter range derived from FWP and Western Resource Development 1989f mapping as modified based on KNF and FWP biologists' knowledge of moose habitat use.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Impacts to moose from Alternative 3 would be similar to Alternative 2, except that less moose winter range and calving habitat would be impacted. In Alternative 3, about 1,904 acres of moose winter range would be impacted, mostly as a result of the tailings impoundment and LAD Areas (Table 202). Alternative 3 would include more road access changes and more habitat acquisition, and would more effectively minimize potential effects on moose. In addition, in Alternative 3 wildlife mortality due to vehicle collisions would be monitored. If, in consultation with the FWP, wildlife mortality from road-killed animals were found to be excessive, mitigation measures would be developed to reduce mortality risks.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts to moose from Alternative 4 would be similar to Alternatives 2 and 3, except that less moose winter range and calving habitat would be affected. In Alternative 4, about 2,079 acres of moose winter range would be affected, mostly as a result of the tailings impoundment (Table 202).

Alternative A – No Transmission Line

Alternative A would have no impacts on moose habitat.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

For Alternative B, some winter range would be disturbed in both the Crazy and Silverfish PSUs, but not enough to change the cover-to-forage ratio. About 41 acres of winter range would be disturbed in the Crazy PSU, while about 60 acres of winter range would be disturbed in the Silverfish PSU (Table 203). All disturbed areas, such as access roads, pulling and tensioning sites, and transmission line clearing areas, would be seeded with grass and shrub species after transmission line construction. Areas where trees were trimmed, but otherwise not disturbed, would be allowed to establish naturally as grassland or shrubland. If revegetation were successful, disturbed areas of winter range would provide additional forage habitat as forage species become established, thereby moving moose habitat conditions in the Silverfish PSU toward KFP objectives. Impacts to moose would be minimized through application of construction timing restrictions in moose winter range. After the transmission line was removed, all newly constructed roads would be redisturbed during blading and contouring, before being seeded. Impacts to moose winter range would be at least partially minimized through MMC's proposed land acquisition program. Acquired parcels would be managed for grizzly bear use in perpetuity, and could improve or contribute suitable moose winter habitat if the acquired parcels potentially provided winter range characteristics and were managed to improve winter moose habitat. Current populations of moose would likely be maintained in Alternative B, despite the habitat disturbance.

The eastern portion of the Alternative B transmission line alignment would occur within the wildlife linkage zone in the Fisher River Valley. Impacts of Alternative B on moose in the wildlife linkage zone would be the same as described for elk in section 3.24.3, *Management Indicator Species*.

Alternative C – Modified North Miller Creek Transmission Line Alternative

Impacts of Alternative C on moose would be similar to Alternative B, except that slightly less moose winter range would be disturbed in the Crazy PSU and slightly more moose winter range would be affected in the Silverfish PSU. Alternative C would include more road access changes and more habitat acquisition, and would more effectively minimize potential effects on moose. Also, impacts to moose also would be minimized through application of construction timing restrictions in moose winter range.

A relatively small portion of the Alternative C transmission line would cross the Fisher River Valley in the wildlife linkage zone, potentially discouraging moose movement in a localized area due to transmission line construction activities. Impacts of Alternative C on moose in the wildlife linkage zone would be the same as described for elk in section 3.24.3, *Management Indicator Species*.

Alternative D – Miller Creek Transmission Line Alternative

Impacts of Alternative D would be similar to Alternative C, except that slightly less moose winter range would be impacted in the Crazy and Silverfish PSUs. Impacts of Alternative D on moose in the wildlife linkage zone in the Fisher River Valley would be the same as Alternative C.

Alternative E – West Fisher Creek Transmission Line Alternative

Impacts of Alternative E would be similar to Alternative C, except that slightly less moose winter range would be impacted in the Crazy PSU, while slightly more moose winter range would be impacted in the Silverfish PSU.

Impacts of Alternative E on moose in the wildlife linkage zone in the Fisher River Valley would be the same as Alternative C.

Combined Mine-Transmission Line Effects

Impacts to moose winter range and percent cover in moose winter range in the analysis area are shown in Table 204. Impacts to percent security habitat and percent habitat effectiveness in the Crazy and Silverfish PSUs are shown in Table 205. Combined impacts on percent cover in summer range and MAs 15, 16 and 17; movement areas; road densities; and the creation of new openings would be the same as white-tailed deer in the Crazy PSU, and the same as elk in the Silverfish PSU. Impacts to white-tailed deer and elk are described in section 3.24.3, *Management Indicator Species*.

Table 204. Impacts to Moose Winter Range in the Analysis Area by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] No Mine Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Cherry Creek Impoundment Area		
	TL-A	TL-B	TL-C	TL-D	TL-E	TL-C	TL-D	TL-E
Crazy PSU								
Cover in Winter Range Impacted (acres)	0	2,052	1,739	1,725	1,725	1,731	1,717	1,717
Percent Cover/forage Moose Winter Range[1]	90/10 (50/50)	80/20	82/18	82/18	82/18	82/1/	82/18	82/18
Silverfish PSU								
Cover in Winter Range Impacted (acres)	0	100	60	76	71	100	76	71
Percent Cover/forage Moose Winter Range[1]	97/3 (50/50)	97/3	97/3	97/3	96/4	97/3	97/3	96/4
All Lands in Analysis Area								
Moose Winter Range Impacted (acres)	0	2,696	2,223	2,228	2,313	2,507	2,404	2,489

Numbers in parentheses represent KFP standards or desired conditions.
Impacts shown are for the transmission line construction phase, which represents maximum estimated impacts.
[1] Percent forage habitat is likely underestimated because moose will forage in shrubfields that may be mapped as cover.
Source: GIS analysis by ERO Resources Corp. using KNF data and moose winter range derived from FWP and Western Resource Development 1989f mapping as modified based on KNF and FWP biologists' knowledge of moose habitat use.

Alternative 2B would affect the most moose winter range of all combined mine-transmission line alternatives, resulting in impacts to 2,696 acres, while Alternative 3C would impact the least moose winter range, impacting 2,223 acres. Most impacts to moose winter range from the combined action alternatives would result in losses of moose habitat within the disturbance areas for the impoundment sites and LAD Areas, and would likely result in the displacement of moose to adjacent winter range and calving sites. In all combined action alternatives, cover-to-forage ratios would shift due to clearing of cover, but areas cleared for the mine components would not provide forage habitat until after they were reclaimed. In all combined action alternatives, areas disturbed for transmission line construction would be seeded with grass and shrub species after transmission line construction and could provide additional forage habitat as forage species become established.

Table 205. Percent Moose Security Habitat, Habitat Effectiveness, and Open Road Densities in the Crazy and Silverfish PSUs by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] No Mine Existing Condition	[2] MMC's Proposed Mine		[3] Agency Mitigated Poorman Impoundment Alternative						[4] Agency Mitigated Little Cherry Creek Impoundment Alternative					
		TL-B		TL-C		TL-D		TL-E		TL-C		TL-D		TL-E	
		Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]
Crazy PSU															
Percent Security Habitat[3]	40 (>30)	36	36	40	40	40	40	40	40	40	40	40	40	40	40
Habitat Effectiveness[4]	53 (>68)	49	50	52	52	52	53	52	52	52	52	52	52	52	52
Silverfish PSU															
Percent Security Habitat[3]	57 (>30)	55	57	55	57	57	57	57	57	55	57	57	57	57	57
Habitat Effectiveness[4]	76 (>68)	74	76	74	76	76	76	74	76	74	76	76	76	74	76

Numbers in parentheses represent KFP standards or desired conditions.
[1] Const = during mine construction.
[2] Ops = during transmission line operations.
[3] Security habitat is calculated by buffering all roads open during the fall (October 15 to November 30) by 0.5 mile. The remaining area equals the effective habitat. No security habitat occurs on private or state land in the analysis area.
[4] Habitat effectiveness is calculated by buffering all roads open during the summer period (July 1 to October 14) by 0.25 mile. The remaining area within the PSU equals the effective habitat.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Alternative 2B includes an access change in NFS road #4724 from April 1 to June 30 to mitigate for impacts to grizzly bears and the agencies' alternatives would include access changes (installation of barriers or gates and public access changes) for several roads to mitigate for the loss of big game security and impacts to grizzly bear. These access changes are taken into account in security, habitat effectiveness, and ORD calculations.

Alternative 2B would reduce the percent security habitat in the Crazy PSU by 4 percent during construction and operations, although it would still be greater than KFP-recommended levels. Due to access changes associated with mitigation, none of the combined agencies' alternatives would affect percent security habitat in the Crazy PSU. Alternatives 2B, 3C, and 4C would result in 2 percent reduction in moose security habitat in the Silverfish PSU during transmission line construction. Percent security habitat would return to existing levels following transmission line construction. Alternatives 3D, 3E, 4D, and 4E would not change percent security habitat in the Silverfish PSU.

Overall, Alternative 2B would affect habitat effectiveness the most. Alternative 2B would decrease habitat effectiveness in the Crazy PSU by 4 percent during construction and 3 percent during operations. With the exception of Alternative 3D, the combined agencies' alternatives would decrease habitat effectiveness in the Crazy PSU by 1 percent during construction and operations. In Alternative 3D, habitat effectiveness in the Crazy PSU would return to existing levels during operations. Alternatives 2B, 3C, 3E, 4C, and 4E would result in a 2 percent decrease in habitat effectiveness in the Silverfish PSU during construction. Following transmission line construction, habitat effectiveness would return to existing levels for these alternatives. None of the other combined action alternatives would affect habitat effectiveness in the Silverfish PSU.

All combined action alternatives would likely result in the displacement of moose to adjacent winter range and calving sites. If moose populations in surrounding areas subsequently exceed carrying capacity as a result of this habitat loss, the moose population may be adversely affected. Widening and improvement of the Bear Creek Road, and winter snowplowing of plant access and haul roads could lead to increased vehicle volumes and speeds, and an increase in moose use of these roads as travel routes, which could increase the risk of moose mortality from vehicle collisions.

The eastern segment of the Alternative 2B transmission line corridor would occur within the wildlife linkage zone in the Fisher River Valley. Relatively small segments of all combined action alternatives would cross the Fisher River Valley in the wildlife linkage zone. The portions of the combined agencies' alternative transmission lines that would parallel U.S. 2 would be located upslope and out of the Fisher River Valley, and would not likely affect moose movement in the linkage zone. Impacts of the combined mine-transmission line alternatives on moose in the Fisher River Valley wildlife linkage zone are the same as described for elk in section 3.24.3, *Management Indicator Species*.

For all combined action alternatives, impacts to moose winter range during transmission line construction would be minimized through the application of construction timing restrictions. Winter range impacts also would be at least partially minimized through MMC and the agencies' land acquisition programs. Acquired parcels would be managed for grizzly bear use in perpetuity, and could improve or contribute suitable moose winter habitat if the acquired parcels potentially provided winter range characteristics and were managed to improve winter moose habitat. Of the 50 parcels identified as potential replacement habitat for mitigating the effects of the proposed project, 21 may provide moose habitat. The agencies' Wildlife Mitigation Plan (section 2.5.7.3, *Wildlife Mitigation*) would include more road access changes and more habitat acquisition, and would more effectively minimize potential effects on moose. For combined agencies' alternatives, busing employees to the

work site would reduce the risk of moose mortality from vehicle collisions. For the combined agencies' alternatives, wildlife mortality due to vehicle collisions would be monitored. If, in consultation with the FWP, wildlife mortality from road-killed animals road-killed animals were found to be excessive, mitigation measures would be developed to reduce mortality risks. The transportation plan included with the combined agencies' alternatives also would reduce the risks of moose mortality from vehicle collisions.

Cumulative Effects

Alternative 1A would not contribute to cumulative impacts on moose. Cumulative effects of the mine action alternatives, in combination with other reasonably foreseeable actions would result in additional impacts to moose winter range, and could result in a decrease in the moose population in HD 105. Private land acquired for grizzly bear mitigation for the proposed project and other reasonably foreseeable actions could cumulatively improve or contribute suitable moose winter habitat if they potentially provided winter range characteristics and were managed to improve winter moose habitat. Thus, cumulative impacts could be reduced through road access changes and habitat acquisitions associated with mitigation for reasonably foreseeable actions.

3.24.7.2.4 Regulatory/Forest Plan Consistency

There are no specific KFP or regulatory standards for impacts to moose. Regulatory and KFP compliance for deer and elk guideline parameters have been discussed in section 3.24.3, *Management Indicator Species*.

3.24.7.3 State Species of Concern

3.24.7.3.1 Analysis Area and Methods

FWP and MNHP define Montana Species of Concern as "native animals breeding in the state that are considered "at risk" due to declining population trends, threats to their habitats, and/or restricted distribution" (FWP and MNHP 2006). State species of concern potentially impacted by the Montanore Project were determined according to their geographic and elevational range and habitat. Impacts to state species of concern were evaluated based on effects on broad vegetation communities described in section 3.21, *Vegetation* and effects on habitat that has been modeled for species with similar habitat requirements, specifically the black-backed woodpecker and the northern goshawk. Potential impacts on many state species of concern are addressed in section 3.24.4, *Forest-Sensitive Species* or 3.24.5, *Threatened, Endangered, and Proposed Species*. This section addresses impacts to the remaining terrestrial state species of concern potentially occurring in the analysis area. Impacts to aquatic species of concern are addressed in section 3.6, *Aquatic Life and Fisheries*.

The analysis area for evaluating direct, indirect, and cumulative project impacts to individuals and their habitat is the Crazy and Silverfish PSUs and any non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments.

Northern Goshawk

Goshawk population ecology, biology, habitat description, and relationships identified by research are described in McGrath *et al.* (2003) and Reynolds *et al.* (1992). That information is incorporated by reference. Goshawk occurrence data come from recent District wildlife observation records and KNF historical data (NRIS FAUNA). Potential goshawk habitat in the Crazy and Silverfish PSUs was estimated based on the KNF CEM and TSMRS vegetation data and the KNF CEM goshawk habitat model (see KNF project record). Goshawk habitat for private and state land outside of the Crazy and Fisher PSUs was based on old growth mapping, as described in section 3.21, *Vegetation*. The

potential population index, referred to as the PPI, for the northern goshawk was calculated based on an average goshawk pair territory of 5,400 acres (Reynolds *et al.* 1992).

3.24.7.3.2 Affected Environment

Vertebrate state species of concern potentially impacted by the Montanore Project are shown in Table 206. Detailed descriptions of physical characteristics, life history, habitat requirements, and distribution are available in the project record. The northern goshawk has been removed from the list of Forest Sensitive Species (McAllister 2007), but is listed as a state species of concern. Specific information about the northern goshawk is available for the analysis area and is summarized below.

Two historical goshawk nesting territories occur in close proximity to the Little Cherry Creek Tailings Impoundment Site. Both nests, one in the Bear Creek drainage and the other in the Little Cherry Creek drainage, were documented in 1983, and have not been known to be active since that date. No goshawk responses were detected during MNHP surveys of the two historical nesting territories in 2005 or 2006 (MNHP 2006b). No goshawks were observed during formal surveys conducted by the Forest Service from 2004 to 2006 near the proposed mine facilities, although one fledgling goshawk was observed in 2005 during surveys conducted in the Midas Creek drainage (see District files). The Forest Service conducted formal goshawk surveys in and adjacent to the proposed Montanore transmission line alignments during the summer of 2005 but did not detect any goshawks. No known or historical nesting territories have been documented in the Silverfish PSU. One potential nesting territory was found in August 2002 in Iron Meadow Creek, when two goshawks were encountered during an old growth survey. No nest tree was located (see District files). Despite the lack of recent goshawk observations, suitable habitat is available at several sites in the analysis area, and it is likely that northern goshawks are present in these areas at least seasonally (Westech 2005a).

Based on potential habitat from Johnson (1999) and the average goshawk pair territory, the minimum PPI for the KNF would be 139 goshawk pairs. Johnson (1999) shows goshawk presence confirmed in all eight planning units on the KNF. According to KNF data, there are 34 known or suspected pairs and an additional 10 known individual goshawks on the KNF. The Crazy PSU contains about 13,291 acres of potential goshawk habitat, while the Silverfish PSU contains about 12,852 acres of potential goshawk habitat, based on habitat modeling. Based on the average goshawk pair territory, the PPI for each of the PSUs is two goshawk pairs.

3.24.7.3.3 Environmental Consequences.

State sensitive species habitat potentially affected by the mine and transmission line alternatives is shown in Table 207 and Table 208 and described in the following subsections.

Alternative 1 – No Mine

Alternative 1 would have no impacts on state species of concern.

Table 206. State Species of Concern Potentially Impacted by the Montanore Project.

Common Name	Scientific Name	State Rank	Habitat	Habitat Used for Impacts Analysis
Fringed Myotis	*Myotis thysanodes*	S3	Riparian and dry mixed conifer forest	Wetland/riparian and coniferous forest
Boreal Chickadee	*Poecile hudsonica*	S1S2	Coniferous and mixed forests	Coniferous forest
Great Gray Owl	*Strix nebulosa*	S3	Coniferous forest	Coniferous forest
Lewis' Woodpecker	*Melanerpes lewis*	S2B	Open forest and woodland that may have been logged or burned, riparian forest	Previously harvested coniferous forest, wetland/riparian
Northern Goshawk	*Accipiter gentiles*	S3	Old growth and other mature, closed canopy forest; requires large coniferous or deciduous trees in older stands for nesting	Mature or old growth forest (modeled northern goshawk habitat)
Olive-Sided Flycatcher	*Contopus cooperi*	S3B	Early seral forest/shrub patches, including post-fire habitat	Recently burned forest and areas with high snag density (high-quality black-backed woodpecker habitat) and previously harvested coniferous forest
Northern Alligator Lizard	*Elgaria coerulea*	S3	Talus/rock outcrops in open areas or low canopy cover shrub or forest habitat	Previously harvested coniferous forest
Western Skink	*Eumeces skiltonianus*	S3	Open ponderosa pine woodland and open areas in or near talus	Coniferous forest, previously harvested coniferous forest
Gillette's Checkerspot	*Euphydryas gillettii*	S2	Wet meadows and clearcut areas	Wetland/ riparian habitat, previously harvested coniferous forest
Magnum Mantleslug	*Magnipelta mycophaga*	S1S3	Moist coniferous forest near water	Wetland/riparian habitat
Pygmy Slug	*Kootenai burkei*	S1S2	Moist coniferous forest	Wetland/riparian habitat
Robust Lancetooth	*Haplotrema vancouvernese*	S1S2	Moist coniferous forest	Wetland/riparian habitat
Sheathed Slug	*Zacoleus idahoensis*	S2S3	Mesic/moist coniferous forest	Wetland/riparian habitat
Smoky Taildropper	*Prophysaon humile*	S1S3	Moist coniferous forest	Wetland/riparian habitat

Key to State ranking codes:
S1-At high risk because of extremely limited and/or rapidly declining numbers, range, and/or habitat, making it highly vulnerable to extirpation in the state.
S2-At risk because of very limited and/or declining numbers, range, and/or habitat, making it vulnerable to global extinction or extirpation in the state.
S3-Potentially at risk because of limited and/or declining numbers, range, and/or habitat, even though it may be abundant in some areas.
B-Breeding season.

Alternative 2 – MMC's Proposed Mine

Species of concern most affected by Alternative 2 would be those associated with coniferous forest, followed by species associated with previously harvested coniferous forest (Table 207). About 72 acres of riparian and wetland areas providing potential habitat for species of concern would be affected by Alternative 2. All wetlands affected would be replaced with wetlands with similar functions and values. Alternative 2 would affect more coniferous forest community, regeneration harvest community, and riparian areas than the other mine alternatives. No known goshawk nests would be impacted in the analysis area. Goshawk habitat would not be impacted by Alternative 2 in the Silverfish PSU. About 511 acres of potential goshawk habitat would be lost as a result of Alternative 2, but these impacts would not change the existing PPI (Table 207). Alternative 2 would impact 473 acres of recently burned forest with snags providing potential habitat for the olive-sided flycatcher. At mine closure, disturbed habitat would be reclaimed, and habitat would return to pre-mine conditions in the long term. For forested habitat, including goshawk habitat, this would take several decades. Alternative 2 may result in disturbance to some state species of concern, in particular the vertebrate species, due to noise and human presence associated with construction and operations. Disturbance effects could cause some species to move to less disturbed areas. Alternative 2 could result in the destruction of nests of bird species of concern or direct mortality of invertebrate species of concern. Although Alternative 2 could affect individuals, it would not likely result in population declines for species of concern.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

State species of concern associated with previously coniferous forest would be most affected by Alternative 3, followed by species associated with coniferous forest (Table 207). Alternative 3 would affect the least riparian and wetland areas providing potential habitat for state species of concern (about 5 acres). All wetlands affected would be replaced with wetlands with similar functions and values. In comparison to Alternative 2, Alternative 3 would result in 571 acres less total habitat lost than Alternative 2 because the tailings impoundment would be smaller and the plant site would be located in the same drainage as the adits (Table 141). Impacts to northern goshawk from Alternative 3 would be the same as Alternative 2, except that less habitat would be affected (409 acres) (Table 207). Alternative 3 would impact the least recently burned forest with snags providing potential habitat for the olive-sided flycatcher, affecting 261 acres. At mine closure, disturbed habitat would be reclaimed, and habitat would potentially be restored to pre-mine conditions in the long term. For forested habitat, including goshawk habitat, this would take a considerable amount of time. Alternative 3 could result in disturbance to some state species of concern, in particular the vertebrate species, due to noise and human presence associated with construction and operations. Disturbance effects may cause some species to move to less disturbed areas. Alternative 3 may result in the destruction of nests of bird species of concern or direct mortality of invertebrates. Although Alternative 3 could affect individuals, it would not likely result in population declines for species of concern.

As described in the agencies' Wildlife Mitigation Plan (section 2.5.7.3, *Wildlife Mitigation*), Alternative 3 includes timing restrictions and pre-construction nest surveys for northern goshawks that would minimize the risk of nest destruction or abandonment for this species. If an active nest were found in the project vicinity, tree removal would not occur in an avoidance area appropriate for the species until young have fledged. These measures would minimize potential impacts to nesting black-backed woodpeckers and northern goshawks.

Table 207. Potential Impacts to State Sensitive Species in the Analysis Area by Mine Alternative.

Habitat Type	[1] No Mine Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment	[4] Agency Mitigated Little Cherry Creek Impoundment
Coniferous Forest (acres)	0	1,560	971	1,094
Previously Harvested Coniferous Forest (acres)	0	949	1,035	1,102
Wetland/Riparian Habitat (acres)	0	72	5	58
Mature or Old Growth Forest (acres)	0 (0)	511 (0)	309 (0)	499 (0)
Recently Burned Forest and Areas with High Snag Density (acres)	0	473	261	627

Number in parentheses is change in the potential population index (PPI) for the northern goshawk from existing conditions, based on an average goshawk pair territory of 5,400 acres.
Species associations are:

Coniferous forest - the boreal chickadee, great gray owl, and western skink.

Previously harvested coniferous forest - Lewis' woodpecker, olive-sided flycatcher, northern alligator lizard, western skink, and Gillette's checkerspot.

Wetland/ riparian habitat – fringed myotis, Lewis' woodpecker, Gillette's checkerspot, magnum mantlebug, pygmy slug, robust lancetooth, sheathed slug, and smoky taildropper.

Mature or old growth forest (goshawk habitat) delineated by Johnson (1999) model for National Forest System land and old growth mapped for private and state land in the analysis area – northern goshawk.

Recently burned forest and areas with high snag density (high-quality black-backed woodpecker habitat, as described in section 3.24.4, *Forest-Sensitive Species*) – olive-sided flycatcher.

Source: GIS analysis by ERO Resources Corp. using KNF data and vegetation mapping in Westech 2005d and MMI 2005b.

Table 208. Potential Impacts to State Sensitive Species in the Analysis Area by Transmission Line Alternative.

Habitat Type	[A] No Transmission Line/ Existing Conditions	[B] MMC's Proposed Transmission Line (North Miller Creek Alternative)	[C] Modified North Miller Creek Transmission Line	[D] Miller Creek Transmission Line	[E] West Fisher Creek Transmission Line
Coniferous Forest (acres)	0	149	168	181	120
Previously Harvested Coniferous Forest (acres)	0	150	155	149	209
Wetland/Riparian Habitat (acres)	0	12	5	14	29
Mature or Old Growth Forest (acres)	0 (0)	42 (0)	26 (0)	31 (0)	37 (0)
Recently Burned Forest and Areas with High Snag Density (acres)	0	46	93	118	133

Number in parentheses is change in the potential population index (PPI) for the northern goshawk from existing conditions, based on an average goshawk pair territory of 5,400 acres.

Species associations are:

Coniferous forest - boreal chickadee, great gray owl, and western skink.

Previously harvested coniferous forest - Lewis' woodpecker, olive-sided flycatcher, northern alligator lizard, western skink, and Gillette's checkerspot.

Wetland/ riparian habitat – fringed myotis, Lewis' woodpecker, Gillette's checkerspot, magnum mantlebug, pygmy slug, robust lancetooth, sheathed slug, and smoky taildropper.

Mature or old growth forest (goshawk habitat) delineated by Johnson (1999) model for National Forest System land and old growth mapped for private and state land in the analysis area – northern goshawk.

Recently burned forest and areas with high snag density (high-quality black-backed woodpecker habitat, as described in section 3.24.4, *Forest-Sensitive Species*) – olive-sided flycatcher.

Source: GIS analysis by ERO Resources Corp. using KNF data and vegetation mapping in Westech 2005d and MMI 2005b.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts to state species of concern from Alternative 4 would be similar to Alternative 2, except that less coniferous forest and more previously harvest coniferous forest would be affected (Table 207). Alternative 4 would affect less riparian and wetland areas (about 58 acres) providing potential habitat for species of concern than Alternative 2 (about 72 acres). All wetlands affected would be replaced with wetlands with similar functions and values. Compared to other alternatives, Alternative 4 would impact the most recently burned forest with snags that provides potential habitat for the olive-sided flycatcher, affecting 627 acres. In comparison to Alternative 2, total habitat losses resulting from Alternative 4 would be 328 acres less because the plant site

would be located in the same drainage as the adits. Impacts to northern goshawk from Alternative 4 would be the same as Alternative 2, except that less habitat would be affected (399 acres) (Table 207).

At mine closure, disturbed habitat would be reclaimed, and habitat would potentially be restored to pre-mine conditions in the long term. For forested habitat, including goshawk habitat, this would take a considerable amount of time. Alternative 4 could result in disturbance to some state species of concern, in particular the vertebrate species, due to noise and human presence associated with construction and operations. Disturbance effects could cause some species to move to less disturbed areas. Alternative 4 could result in the destruction of nests of bird species of concern or direct mortality of invertebrates. Although Alternative 4 could affect individuals, it would not likely result in population declines for species of concern. Surveys and timing restrictions described for Alternative 3 also would apply to Alternative 4.

Alternative A – No Transmission Line

Alternative A would not affect state species of concern habitat.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Overall, Alternative B would affect the least amount of potential species of concern habitat compared to the other transmission line alternatives, due to a narrower clearing width (Table 208). Alternative B would affect about the same amount of coniferous forest and previously harvested coniferous forest providing potential habitat for associated species. No known goshawk nests would be impacted in either the Crazy or Silverfish PSU by Alternative B. About 42 acres of potential goshawk habitat would be lost as a result of Alternative B. These impacts would be too small to change the existing PPI. Alternative B would impact the least recently burned forest with snags, affecting 46 acres. At mine closure, disturbed habitat would be reclaimed, and habitat would potentially be restored to pre-mine conditions in the long term. For forested habitat, including goshawk habitat, this would take a considerable amount of time. Alternative B could result in disturbance to some state species of concern, in particular the vertebrate species, due to noise and human presence associated with construction. However, disturbance effects would be short-term and would cease after transmission line construction. Alternative B could result in the destruction of nests of bird species of concern or direct mortality of invertebrate species of concern. Although Alternative B could affect individuals, it would not likely result in population declines for species of concern.

The likelihood of the 230-kV transmission line resulting in the electrocution of goshawks is extremely low; electrocution of raptors is primarily a problem associated with lower-voltage distribution lines (APLIC 2006). Also, electrocutions potentially caused by the transmission line would be minimized through implementation of recommendations outlined in APLIC (2006), which are based on a minimum spacing of 60 inches between phases or between phase and ground wires, and the Environmental Specifications (Appendix D).

Because they are highly maneuverable and do not generally fly in flocks, northern goshawks are generally less vulnerable to collisions with power lines than other bird species (Olendorff and Lehman 1986). Although unlikely, it is possible that Alternative B could result in an increased risk of goshawk mortality due to the potential for collisions with the transmission line. Potential collisions of goshawks with the transmission line would be minimized through implementation of recommendations outlined in APLIC (1994), and the Environmental Specifications (Appendix D).

As specified in the Environmental Specifications (Appendix D), Alternative B includes timing restrictions and pre-construction nest surveys for northern goshawks that would minimize the risk of nest destruction or abandonment for this species. If an active nest were found in the project vicinity, tree removal would not occur in an avoidance area appropriate for the species until young have fledged. These measures would minimize potential impacts to nesting black-backed woodpeckers and northern goshawks.

Alternative C – Modified North Miller Creek Transmission Line Alternative

Alternative C would impact slightly more coniferous forest and previously harvested forest providing potential habitat for species of concern than Alternative B (Table 208). Alternative C would impact wetland and riparian areas the least, affecting 5 acres. Direct effects to wetlands are expected to be mostly avoided by placement and location of transmission line facilities and roads outside of wetlands and waters of the U.S. Goshawk habitat would be the least impacted in Alternative C. About 93 acres of recently burned forest with snags providing potential habitat for the olive-sided flycatcher would be affected by Alternative C. Other impacts to state species of concern from Alternative C would be similar to Alternative B.

Alternative D – Miller Creek Transmission Line Alternative

Alternative D would have the greatest impacts on coniferous forest and associated species of concern (Table 208). About 31 acres of potential goshawk habitat would be lost as a result of Alternative D. Alternative D would affect 118 acres of recently burned forest with snags providing potential habitat for the olive-sided flycatcher. These impacts would be too small to change the existing PPI. Other impacts to state species of concern from Alternative D would be similar to Alternative B.

Alternative E – West Fisher Creek Transmission Line Alternative

Because Alternative E is the longest, overall it would have the greatest impacts on potential species of concern habitat of all the transmission line alternatives (Table 208). Impacts from Alternative E would be the greatest for previously harvested coniferous forest, affecting 209 acres. Alternative E would impact the most wetland and riparian habitat and recently burned forest with snags, affecting 29 and 133 acres, respectively. Direct effects to wetlands are expected to be mostly avoided by placement and location of transmission line facilities and roads outside of wetlands and waters of the U.S. Other impacts to state species of concern from Alternative E would be similar to Alternative B.

Combined Mine-Transmission Line Effects

Impacts to state species of concern are shown in Table 209 and discussed in the following paragraphs.

Alternative 2B would impact the most coniferous forest providing habitat for associated species (1,709 acres), while Alternative 3E would impact the least (1,091 acres). Previously harvested coniferous forest would be most affected by Alternative 4E, which would affect 1,311 acres. Alternatives 2B and 4E would have similar impacts on wetlands and riparian habitats, affecting 84 and 87 acres, respectively. In all combined action alternatives, direct effects to wetlands from the transmission line are expected to be mostly avoided by placement and location of transmission line facilities and roads outside of wetlands and waters of the U.S., and all wetlands affected by the mine would be replaced with wetlands with similar functions and values. The goshawk would be most affected by Alternative B, which would result in the loss of 519 acres of

goshawk habitat. The goshawk would be least affected by Alternative 4C, which would affect 425 acres. Recently burned forest with snags providing potential habitat for the olive-sided flycatcher would be most affected by Alternative 4C, which would impact about 745 acres of habitat.

Table 209. Potential Impacts to State Sensitive Species Habitat in the Analysis Area by Combined Mine-Transmission Line Alternative.

Habitat Type	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Cherry Creek Impoundment Area		
	TL-B	TL-C	TL-D	TL-E	TL-C	TL-D	TL-E
Coniferous Forest (acres)	1,709	1,139	1,152	1,091	1,262	1,275	1,214
Previously Harvested Coniferous Forest (acres)	1,054	1,190	1,184	1,244	1,257	1,251	1,311
Wetland/Riparian Habitat (acres)	84	10	19	34	63	72	87
Mature or Old Growth Forest (acres)	553	435	440	446	425	430	436
Recently Burned Forest and Areas with High Snag Density (acres)	519	354	379	364	720	745	730

Species associations are:

Coniferous forest - boreal chickadee, great gray owl, and western skink.

Previously harvested coniferous forest - Lewis' woodpecker, olive-sided flycatcher, northern alligator lizard, western skink, and Gillette's checkerspot.

Wetland/riparian habitat – fringed myotis, Lewis' woodpecker, Gillette's checkerspot, magnum mantlebug, pygmy slug, robust lancetooth, sheathed slug, and smoky taildropper.

Mature or old growth forest (goshawk habitat) delineated by Johnson (1999) model for National Forest System land and old growth mapped for private and state land in the analysis area – northern goshawk.

Recently burned forest and areas with high snag density (high-quality black-backed woodpecker habitat, as described in section 3.24.4, *Forest-Sensitive Species*) – olive-sided flycatcher.

Source: GIS analysis by ERO Resources Corp. using KNF data and vegetation mapping in Westech 2005d and MMI 2005b.

In all combined action alternatives, disturbed habitat would be reclaimed at mine closure, and habitat would potentially be restored to pre-mine conditions in the long term. For forested habitat, including goshawk habitat, this would likely take centuries. All combined action alternatives could result in disturbance to some state species of concern, in particular the vertebrate species, due to noise and human presence associated with construction and operations. Disturbance effects could cause some species to move to less disturbed areas. All combined action alternatives could result in the destruction of nests of bird species of concern or direct mortality of invertebrates. Although all combined action alternatives could affect individuals, they would not likely result in population declines for species of concern.

In all combined action alternatives, the likelihood of the 230-kV transmission line resulting in the electrocution of goshawks is extremely low; electrocution of raptors is primarily a problem associated with lower-voltage distribution lines (APLIC 2006). Also, electrocutions potentially caused by the transmission line would be minimized through implementation of recommendations outlined in APLIC (2006), which are based on a minimum spacing of 60 inches

between phases or between phase and ground wires, and the Environmental Specifications (Appendix D).

Because they are highly maneuverable and do not generally fly in flocks, northern goshawks are generally less vulnerable to collisions with power lines than other bird species (Olendorff and Lehman 1986). Although unlikely, it is possible that the action alternatives could result in an increased risk of goshawk mortality due to the potential for collisions with the transmission line. Potential collisions of goshawks with the transmission line would be minimized through implementation of recommendations outlined in APLIC (1994), and the Environmental Specifications (Appendix D).

In all combined action alternatives, as specified in the Environmental Specifications (Appendix D), and the agencies' Wildlife Mitigation Plan (sections 2.5.7.3, *Wildlife Mitigation* and 2.9.4, *Wildlife Mitigation Measures*), either tree removal would not occur during the breeding season for northern goshawks, or surveys would be conducted in potential habitat for this species prior to project construction to identify potentially impacted nests. If an active nest were found in the project vicinity, tree removal would not occur in an avoidance area appropriate for the species until young have fledged. These measures would minimize potential impacts to northern goshawks. Alternative 2B does not include timing restrictions or northern goshawk surveys of the mine disturbance area.

Cumulative Effects

Past actions, particularly timber harvest, road construction, and fire-suppression activities, have altered the analysis area, resulting in a reduction in early and late succession habitats; conditions favoring shade-tolerant, fire-intolerant species; loss of large snags and down wood; increases in tree density; and a shift to a largely mid-seral structural stage (USDA Forest Service 2003b). Firewood cutting would continue to occur where open roads provided access to old growth habitat, contributing to removal of snags important to several state species of concern, such as the boreal chickadee, Lewis' woodpecker, northern alligator lizard, and western skink. Continuing development of private lands, including timber harvest, home construction, and land clearing would contribute to losses of forested habitat in the analysis area.

The Miller-West Fisher Vegetation Management Project would include regeneration harvest of about 475 acres, slash treatment of 681 acres, and prescribed burning of 3,751 acres of National Forest System lands in the Silverfish PSU. Timber harvest and other clearing activities planned for the Miller-West Fisher Vegetation Management Project in the Silverfish PSU would contribute to cumulative losses of coniferous forest habitat and snags and down wood. However, activities associated with the Miller-West Fisher Vegetation Management Project are expected to retain cavity habitat within KFP-recommended levels for the Silverfish PSU. Also, prescribed burns associated with the Miller-West Fisher Vegetation Management Project would create habitat for the olive-sided flycatcher and other state species of concern found in open habitats. Surface disturbance from other reasonably foreseeable actions in the analysis area would be minimal. The combined action alternatives, in combination with other reasonably foreseeable actions could result in cumulative noise and other human-caused disturbance to bird species of concern and the fringed myotis, causing them to move to less disturbed areas.

3.24.7.3.4 Regulatory/Forest Plan Consistency

KFP. With the incorporation of the KFP amendment discussed in section 3.24.3, *Management Indicator Species*, all agencies' combined mine-transmission line alternatives would meet all KFP

direction for general forest MIS species (*i.e.,* white-tailed deer and elk) representing moose (KFP Vol. 1, II-22 #3, III-45 #8, and III-49 #7).

During transmission line construction, Alternatives 3D, 3E, 4D, and 4E would increase ORD in areas currently managed as MA 12. All action alternatives would include a project-specific amendment to the KFP to change MA 12 within a 500-foot corridor designated for the transmission line corridor to MA 23. The amendment would be for the duration of the proposed Montanore Project. KFP amendments have been discussed in section 3.14, *Land Use*. All new or opened roads in MA 12 associated with the transmission line would be within the 500-foot corridor reallocated as MA 23.

The action alternatives could impact individuals and/or their habitat, but would not contribute to a trend toward federal listing or loss of species viability for state species of concern. Coniferous forest, previously harvested coniferous forest, wetland and riparian habitat, goshawk habitat, and black-backed woodpecker habitat providing potential habitat for state species of concern would be disturbed, but a small proportion of available habitat would be impacted. Sufficient habitat within the in the analysis area would likely remain to support existing populations of state species of concern.

3.24.7.4 Irreversible and Irretrievable Commitments

All disturbed areas would be reclaimed and revegetated at mine closure. With the exception of old growth habitat, there would be no irreversible commitments of habitat for moose or state species of concern due to any of the action alternatives. Action alternatives would result in an irreversible commitment of old growth forest providing potential goshawk habitat. The recovery time of old growth forest would preclude restoration for centuries following disturbance.

Irretrievable commitments of moose winter range and calving habitat would occur in the Crazy and Silverfish PSUs due to disturbance from the impoundment, LAD Areas, plant site, and other mine facilities, and construction of the transmission line. Irretrievable commitments of species of concern habitat would occur in all action alternatives. In all action alternatives, recovery of moose winter range and calving habitat and species of concern habitat would not occur until after mine closure and reclamation.

3.24.7.5 Short-term Uses and Long-term Productivity

Most losses of moose winter range and calving habitat and species of concern habitat resulting from the action alternatives would last until mine closure and reclamation. Noise and other human-caused disturbance to moose and species of concern would be short-term during the construction phase. Disturbance created by mine operations would last through reclamation, although it would be less intense after the mine was closed.

3.24.7.6 Unavoidable Adverse Environmental Effects

Unavoidable adverse effects to moose and state species of concern would occur from all action alternatives in the analysis area due to losses of habitat where new roads were constructed, mine facilities were built, and the transmission line were constructed.

3.25 Other Required Disclosures

3.25.1 Environmental Justice

Executive Order 12898, Environmental Justice requires federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations when implementing their respective programs, including American Indian programs. The lead agencies' analysis of Environmental Justice follows the CEQ's guidance on Environmental Justice, (CEQ 1997), the EPA's guidance on Environmental Justice (EPA 1998, 1999) and the U.S. Department of Agriculture's regulation on Environmental Justice (USDA 1997b). These documents suggest a step-wise evaluation of Environmental Justice: identification of minority and low-income populations; assessment of effects and determination if the effects would be disproportionately high and adverse, and mitigation. The U.S. Department of Agriculture's regulation indicates an effect on a minority or a low-income population is disproportionately high and adverse if the adverse effect is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the non-minority population and/or non-low-income population.

No minority and low-income populations live in the analysis area. American Indians are a minority population, and although the proposed mine is not located within or adjacent to any tribal reservations, it is located within the boundaries of land covered by the Hell Gate Treaty (see section 3.5, *American Indian Consultation*). All action alternatives would restrict access to mine facility sites to all members of the public, including tribal members. Proposed mitigations in all action alternatives would reduce the effects of access restrictions. The access restrictions would not be disproportionately high and adverse on any minority and low-income population.

3.25.2 Important Farmland, Rangeland, and Forestland

The Farmland Protection Policy Act and USDA Departmental Regulation No. 9500-3 provide protection for important farmland, prime forest land, and prime rangeland. The USDA regulation, 7 CFR Part 658, implements the Farmland Protection Policy Act. The alternatives analyzed in detail would be in compliance with regulations for prime lands. The definition of prime forest land does not apply to lands within the KNF. Lands administered by the Forest Service in the analysis area do not include any important farmlands or prime range lands. In all alternatives, federal lands would be managed with the appropriate consideration to the effects on adjacent lands.

3.25.3 Energy Requirements and Conservation Potential

Alternatives requiring the most construction would have the least potential for conserving energy. The maximum annual energy consumed by all alternatives is estimated at 406,000 megawatts, using a peak demand of 50 megawatts. The amount of energy required to implement any of the action alternatives, in terms of petroleum products, would be insignificant when viewed in light of the production costs and effects of the national and worldwide petroleum reserves.

3.25.4 Urban Quality and the Design of the Built Environment

Implementation of any of the action alternatives would not affect urban quality. No buildings or other forms of man-made structures would be affected by any of the alternatives.

Chapter 4. Consultation and Coordination

4.1 Preparers and Contributors

4.1.1.1 Forest Service

Name	Responsibilities	Education	Experience
Ague, Susan	GIS/Editorial Assistant (2005-2006)		14 years
Bond, Deb	Vegetation/Sensitive Plants	B.S., Forestry Resource Management	27 years
Bratkovich, Al	Wildlife	B.S., Forest Science	31 years
Bones, Stan	Explosives	B.S., Forest Management	37 years
Brundin, Lee	Wildlife	B.S., Fisheries & Wildlife Management	34 years
Carlson, John	Fisheries	M.S., Fisheries B.S., Fisheries	23 years
Edwards, Malcolm	Ranger	B.S., Soils/Range	32 years
Ferguson McDougall, Leslie	NEPA	B.S., Forestry	25 years
Grabinski, Tom	Lands	B.S., Civil Engineering	39 years
Gubel, John	NEPA	B.S., Forestry	27 years
Gurrieri, Joe	Hydrology	M.S., Geology B.A., Geography/Geology	24 years
Hooper, Paul	Fisheries	B.S., Fisheries Biology	17 years
Jeresek, Jon	Recreation	M.S., Forest Pathology	32 years
Johnson, Wayne	Wildlife	B.S., Wildlife Management	33 years
Lacklen, Bobbie	Project Coordinator	B.A., Geology	22 years
Lampton, Linda	GIS	A.A., Business	25 years
Leavell, Dan	Ecology	Ph.D., Ecology M.S., Forest Ecology B.S., Forestry Resource Management	35 years
McKay, John	Geology	B.A., Geology	27 years
Niccolucci, Michael	Socioeconomics	B.A., Economics M.A., Economics	27 years
Odor, Ann	Weeds	B.S., Forestry Resource Management	21 years
Romero, Stephen	Dam Specialist (2005-2007)	M.S., Civil Engineering B.S., Environmental Engineering B.A., Mathematics	10 years
Smith, Lawrence	Forester	A.A., Forestry	36 years
Stantus, Paul	Engineer	B.S., Civil Engineering	31 years
TeSoro, Ray	RO Minerals	B.S., Geology	28 years
Thomas, Pat	Scenery	B.S., Landscape Architecture	34 years
Timmons, Becky	Heritage/American Indian	M.A., Anthropology B.A., Anthropology	28 years
Werner, Peter	Geotechnical	M.S., Mining Engineering Double B.S., Civil Engineering and Geology	18 years

Name	Responsibilities	Education	Experience
Young, Barb	GIS	M.S., Work, Soils B.A., Geology	21 years
Wegner, Steve	Hydrology	B.S., Watershed Management	25 years
White, Mark	Heritage	Double B.S., Anthropology and History	23 years

4.1.1.2 Department of Environmental Quality

Name	Responsibilities	Education	Experience
Blend, Jeff	Socioeconomics	Ph.D., Agricultural Economics M.S., Economics B.S., Economics	9 years
Boettcher, Lisa	Hydrogeology Overall Resource Review	M.S., Geology and Geological Engineering B.S., Geology	19 years
Castro, James	Geochemist	Ph.D., Geochemistry M.S., Physical Chemistry	35 years
Freshman, Charles	Engineering	M.S., Geological Engineering B.A., Geology B.S., Environmental Engineering	25 years
Furniss, George	Hydrogeology	M.S., Geology B.S., Geology	34 years
Jepson, Wayne	Hydrology	M.S., Geology B.A., Earth Sciences	16 years
Johnson, Kathleen	Project Coordinator and Document Review (2005-2007)	M.S., Land Rehabilitation B.S., Landscape Architecture	20 years
Johnson, Nancy	Transmission Line – Major Facility Siting Act	M.L.A., Landscape Architecture M.S., Education B.S., Education	26 years
Jones, Craig	Transmission Line	B.A., Political Science	1 year
Lovelace, Bonnie	Project Coordinator and Document Review (2007 to present)	M.S., Geology B.S., Geology B.S., Mathematics	25 years
McCullough, Warren	Document Review	M.S., Economic Geology B.A., Anthropology	32 years
O'Mara, Jenny	Air Quality Permit and Review	B.S., Environmental Engineering	13 years
Plantenberg, Patrick	Overall Resource Review	M.S., Range Science/Reclamation Research B.S., Plant & Soil Science/Recreation Area Management	35 years
Ridenour, Rebecca	MPDES Permit and Water Quality Review	M.S., Geoscience - Geochemistry B.S., Geological Engineering, Hydrogeology Emphasis	10 years
Ring, Tom	Major Facility Siting Act Certificate Coordination	Double B.S., Fish and Wildlife Management and Earth Science	27 years
Rolfes, Herb	Operating Permit Supervisor and Document Review	M.S., Land Rehabilitation B.A., Earth Space Science, A.S., Chemical Engineering	20 Years

Name	Responsibilities	Education	Experience
Skubinna, Paul	MPDES Permit and Water Quality Review (2005–200)7	M.S., Geology B.S., Earth Science	5 years
Thunstrom, Eric	Air Quality Permit and Review (2005–2007)	B.A., Environmental Engineering	1.5 years

4.1.1.3 EIS Consultant Team

Name/Firm	Responsibilities	Education	Experience
Baud, Karen ` Resources Corp.	Assistant Project Manager; Wildlife (2006 to present)	M.A., Biology B.A., Biology	18 years
Bauer, Wayne HDR Engineering, Inc.	Electrical Engineering	B.S., Electrical Engineering	23 years
Bergstedt, Lee GEI Consultants, Inc.	Aquatic Life and Fisheries (2007 to present)	M.S., Fishery and Wildlife Biology B.A., Fish and Wildlife Management	13 years
Canton, Steve GEI Consultants, Inc.	Aquatic Life and Fisheries	M.S., Zoology B.A., Biology	30 years
Clark, Martha ERO Resources Corp.	Technical Editor	B.A., English	22 years
Cole, Andy ERO Resources Corp.	Socioeconomics	M.F.S. Forest Science M.A., German B.A., German/Physics	13 years
Galloway, Barbara ERO Resources Corp.	Hydrology	M.S., Water Resources Double B.A., Biology and Environmental Studies	23 years
Galloway, Michael ERO Resources Corp.	Hydrogeology	M.S., Geology B.S., Geology	37 years
Gilbride, Leo Agapito and Associates, Inc.	Mine Engineering	M.S., Mining Engineering B.S., Civil Engineering	11 years
Grant, Julia ERO Resources Corp.	Assistant Project Manager; Land Use (2005–2006)	M.E.M., Resource Ecology M.F., Forest Resources B.A., Political Science	7 years
Hesker, David ERO Resources Corp.	Graphics	B.F.A., Concentration in Graphic Design	18 years
Hereim, Scott HDR Engineering, Inc.	Electrical Engineering	B.S., Electrical Engineering	9 years
Hodges, Wendy ERO Resources Corp.	Geographic Information Systems	M.S., Environmental Policy and Management B.S., Natural Science	6 years
Holdeman, Mark Holdeman Landscape Architecture, Inc.	Visual	B.L.A., Landscape Architecture	26 years
Kirk, Lisa Enviromin, Inc.	Geochemistry	Ph.D., Microbial Geochemistry M.S., Aqueous Geochemistry B.S., Geology and Environmental Science	23 years

Name/Firm	Responsibilities	Education	Experience
Larmore, Sean ERO Resources Corp.	Cultural Resources	M.A., Archaeology B.A., Anthropology	11 years
Lynch, Jeniffer GEI Consultants, Ltd.	Aquatic Life and Fisheries (2005-2007)	M.S., Environmental Science B.S., Biology	2 years
Lyons, Carol Bridges Unlimited, LLC.	Air Quality	M.S., Chemical Engineering Double B.S., Chemistry and Physics	30 years
Mangle, Bill ERO Resources Corp.	Land Use, Recreation, Wilderness, and Inventoried Roadless Areas	M.S., Natural Resource Policy and Planning B.S., History/Political Science	12 years
Poulter, Don Glasgow Engineering Group, Inc.	Geotechnical	M.S.C.E., Geotechnical Engineering B.S., Civil Engineering	29 years
Sheppard, Asher Asher Sheppard Consulting	Electric and Magnetic Fields	Ph.D., Physics M.S., Physics B.A., Science	30 years
Smith, Garth ERO Resources Corp.	Geographic Information Systems	M.A., Geography B.S., Geography	14 years
Stanwood, Mike ERO Resources Corp.	Socioeconomics	M.S., Mineral Economics B.A., Psychology	28 years
Trenholme, Richard ERO Resources Corp.	Project Management	B.S., Agronomy	30 years
Trujillo, Cindy ERO Resources Corp.	Wetlands and Vegetation	B.S., Biology	8 years
Vandergrift, Tom Agapito and Associates, Inc.	Mine Engineering	M.S., Mining Engineering B.S., Mining Engineering	20 years
Wall, Kay ERO Resources Corp.	Document Production	B.A., Behavioral Science	29 years

The Forest Service and DEQ consulted the following individuals, federal, state, and local agencies and agency personnel during the development of this EIS.

4.1.4 Other Federal, Tribal, State and Local Agencies

Name/Agency or Tribe	Responsibilities
Brown, Jerry Montana Fish, Wildlife, and Parks	Wildlife
Conard, Ben U.S. Fish and Wildlife Service	Wildlife and Threatened & Endangered Species
Goldsberry, Cheryl U.S. Army Corps of Engineers	Wetlands and 404 Permit
Hafferman, Kurt Montana Department of Natural Resources and Conservation	Water Rights
Kasworm, Wayne U.S. Fish and Wildlife Service	Wildlife and Threatened & Endangered Species
Konzen, John Lincoln County Commissioner	Document Review

LaForest, Joe Montana Department of Commerce, Hard Rock Mining Impact Board	Hard Rock Impact Plan Socioeconomics
Lynard, Gene Bonneville Power Administration	Sedlak Park Substation and Loop Line
Peter, Chandler U.S. Army Corps of Engineers	Wetlands and 404 permit
Riley, Jean Montana Department of Transportation	State Highways
Roose, Marianne Lincoln County Commissioner	Document Review
Sandman, Robert Department of Natural Resources and Conservation	Trust Lands
Steinle, Allan U.S. Army Corps of Engineers	Wetlands
Williams, Jim Montana Fish, Wildlife, and Parks	Wildlife
Wilson, Mark USDI Fish and Wildlife Service	Wildlife and Threatened & Endangered Species
Windom, Rita Lincoln County Commissioner	Document Review

4.2 List of Agencies, Organizations and Person to Whom Copies of the Draft EIS Have Been Distributed

This EIS or its Summary has been distributed to individuals who specifically requested a copy of the document either in hard or electronic copy. In addition, copies have been sent to the federal agencies, tribal governments, state and local governments, and organizations representing a wide range of views regarding the proposed Montanore Project. The mailing list was compiled using the names and addresses of the following:

- Parties who participated in public meetings or who submitted written comments
- Parties who have requested copies of the EIS
- Agencies, governments, tribes, and companies potentially affected by the proposed operation
- Agencies and groups consulted during the EIS preparation

A copy of this Draft EIS can be reviewed at the following locations or via the Internet on the Forest Service web page (http://www.fs.fed.us/r1/kootenai/projects/projects/montanore/index.shtml) or the DEQ web page (http://www.deq.state.mt.us/eis.asp):

- Supervisor's Office, Kootenai National Forest, Libby, MT
- Libby Ranger Station, Libby, MT
- Montana Department of Environmental Quality, Helena, MT
- Montana State Library
- Mansfield Library, University of Montana, Missoula, MT

- Lincoln County Library, Libby, MT
- Thompson Falls Public Library, Thompson Falls, MT
- Laurie Hill Library, Heron, MT

Copies of this document are also available on request from:

Kootenai National Forest
31374 U.S. 2 West
Libby, MT 59923-3022
(406) 293-6211

Montana Department of Environmental Quality
PO Box 200901
Helena, MT 59620-0901
(406) 444-1760

Bonneville Power Administration
PO Box 3621
Portland, OR 97208-3621
(503) 230-7334

The following agencies, organizations, and individuals received a copy of the Draft EIS or summary:

4.2.1 Federal, State, or Local Agencies

Advisory Council on Historic Preservation
Army Corps of Engineers
Bonneville Power Administration
Boundary Co Land Use Committee
British Columbia Ministry of Energy, Mines and Petroleum Resources
British Columbia Ministry of Environment
British Columbia Ministry of Forest and Range
Bureau of Land Management
City of Libby
Coeur D'Alene Tribe
Colville National Forest
Confederated Salish-Kootenai
County Commissioner Boundary
County Commissioner Lincoln
County Commissioner Sanders
Environmental Protection Agency
Environmental Protection Agency Region 10
Environmental Protection Agency Region 8
Federal Aviation Administration
Federal Energy Regulatory Commission
Federal Highway Administration
Federal Railroad Administration
Forest Service Governors Office
ID Dept of Agriculture
ID Dept of Environmental Quality
ID Dept of Fish and Game
ID Dept of Lands
ID Dept of Parks and Recreation
ID Dept of Water Resources
ID Office of Species Conservation
ID Senator Jim Risch
ID St Representative Eric Anderson
ID St Senator Shawn Keough
ID State Historic Preservation Office
ID State Historical Society
ID Water Resource Board
Kootenai County Building and Planning Dept
Kootenai National Wildlife Refuge
Kootenai Tribe of ID
Lakes Commission
Legislative Consumer Counsel
Libby Creek Ventures
Libby Public Schools
Lincoln County
Lincoln County Library
Lincoln County Weed and Rodent Program
MT Bureau of Mines and Geology
MT Department of Revenue
MT Department of Transportation
MT Dept of Agriculture
MT Dept of Commerce
MT Dept of Environmental Quality
MT Dept of Natural Resources and Conservation
MT Environmental Quality Counsel
MT Fish Wildlife and Parks
MT Governor Brian Schweitzer
MT Natural Heritage Program
MT Representative Dennis Rehberg
MT Senator Jon Tester
MT Senator Max Baucus
MT St Representative Chas Vincent
MT St Representative Pat Ingraham
MT St Senator Aubyn Curtiss
MT St Senator Jim Elliott
MT State Historic Preservation Office
MT State Library
Natural Resources Conservation Service
Northwest Indian Fisheries Commission
Office of NEPA Policy and Compliance
Public Service Commission
Rocky Mountain Research Station
The City of Troy
Thompson Falls Public Library
Tribal Liaison/KNF
Troy Rural Fire District
U.S. Dept. of Agriculture
U.S. Dept. of Labor

U.S. Dept. of the Interior
U.S. Dept. of Transportation
US Coast Guard
US Geological Survey
USDA APHIS PPD/EAD
USDA Forest Service
USDA National Agricultural Library
USDA Natural Resources Conservation Service
USDI Fish and Wildlife Service
USDI Office of Environmental Policy and Compliance
WA Conservation Commission
WA Dept Fish and Wildlife
WA Dept of CTED
WA Dept of Ecology
WA Dept of Natural Resources

4.2.1.2 Organizations and Businesses

Organizations

Alliance for the Wild Rockies
Amber Public Land Exchange
American Fisheries Society
American Forest and Paper Assn
American Sportfishing Assn
American Wildlands
Avery Area Property Owners Assn
Back Country Houndsmen
Backcountry ATV
Backcountry Horsemen
Backcountry Hunters and Anglers
Biodiversity Legal Foundation
BlueRibbon Coalition
Boone and Crockett Club
Boundary Backpackers - Idaho Conservation League
Bowhunting Preservation Alliance
Bull River Watershed Council
Cabinet Back Country Horsemen
Cabinet Mountains Pika Club
Cabinet Resource Group
Capital Trail Vehicle Assn
Center For Justice
Clark Fork Bass Anglers
Clark Fork Pend Oreille Conservancy
Committee For Idahos High Desert
Communities for a Greater Northwest
Concerned About Grizzlies
Cutthroat Trout Foundation Inc.
Defenders of Wildlife
Earthworks
Eastern Sanders Co Sportsmen
Elk Unlimited
Estuary Corporation
Eureka Dune Runners
Five Valleys Audubon Society
Flathead Lutheran Bible Camp
Flathead Wildlife, Inc.
Foundation For N American Wild Sheep
Friends of Clearwater
Friends of Scotchmans Pk Wldrns
Friends of the Clearwater
Gonzaga Spokane Mountaineers
Great Bear Foundation
Great Burn Study Group
Great Old Broads For Wilderness
Healthy Communities Initiative
High Mountain ATV Assn
Idaho ATV Association Inc.
Idaho Conservation Data Center
Idaho Conservation League
Idaho Environmental Council
Idaho Forest Owners Assn
Idaho Forest Owners Association
Idaho Native Plant Society
Idaho Outfitters and Guides Licensing Board
Idaho Rivers United
Idaho State Snowmobile Assn
Idaho Trout Unlimited
Idaho Women In Timber
Independent Forest Products Assn
Intermountain Forest Assn
International Assn of Fish and Wildlife Agencies
International Mountain Bicycling Association
Kettle Range Conservation Group
Kinnikinnick Chapter of the ID Native Plant Society
Klamath Alliance For Resources and Environment
Kootenai Environmental Alliance
Kootenai Flyfishers
Kootenai Ridge Riders ATV
Kootenai River Development Council
Kootenai River Network
Kootenai Wildlands Alliance
Kootenay Lake Forest District
Libby Area Chamber of Commerce
Libby Rod and Gun Club
Libby Tomorrow
Libby Video Club
Lincoln County Recreation Assn & Troy Snowmobile Club
Lincoln County Sno Kats
Lower Clark Fork Watershed Group
Mansfield Library
Marion Co Humane Society Inc.
Militia of MT
Missoula Bicycle Club
Montana Env. Info. Center
Montanans for Multiple Use
Mountain States Legal Foundation
MT Chapter American Fisheries Society
MT Conservation Corps
MT Native Plant Society
MT Night Riders
MT Petroleum Assn
MT Pilots Assn
MT Snowmobile Assn
MT Trail Vehicle Riders Assn
MT Wilderness Assn
MT Wildlife Federation
MT Wood Products Assn
N ID Audubon Society
N ID Backcountry Horsemen
N ID Trail Blazers and Pacific NW Four Wheel Drive Assoc
N ID Trailblazers
National Audubon Society

National Resources Defense Council
National Rifle Assn
National Shooting Sports Foundation
National Wild Turkey Federation
National Wildlife Federation
Native Forest Network
Nitha
Non-Profit Offroad Community
North Fork Forestry
Northwest Access Alliance
Northwest Coalition for Alt To Pesticides
Northwest Environmental Defense Center
Northwest Mining Association
Northwest Power Planning Council
Noxon Rod and Gun Club
Oregon State Snowmobile Assn
Pacific Legal Foundation
Pacific Northwest Four Wheel Drive Assn
Pacific Rivers Council
Panhandle Trail Riders Assn
Pantra
People For Wyoming
Pilik Ridge RUA
Predator Conservation Alliance
Priest Lake Groomer Committee
Priest Lake Permittees Assn
Priest Lake Trails and Outdoor Rec Assn
Priest River Valley Back Country Horseman
Public Lands Foundation
Recreational Boating and Fishing Foundation
Rock Cr Subdivision RUA
Rock Creek Alliance
Rocky Mountain Elk Foundation
Rocky Mountain Forest District
Sanders County Winter Recreation
Sandpoint Ski Hut Assn
Sandpoint Winter Riders
Save Our Earth
Sci First For Hunters
Selkirk Conservation Alliance
Selkirk Conservation Assn
Sierra Club
Sierra Club Legal Defense Fund
Smoky Mountains Hiking Club
Snow Riders
Snowmobile Alliance of Western States
Society of American Foresters
Spokane Mountaineers
Spokane Mountaineers Conservation Committee
St Joe Cycle Club City of St Maries Council
St Joe Snow Riders
Stenros Brothers Outdoor Adventures
Ten Lakes Snowmobile Club
The Coalition
The Ecology Center
The Lands Council
The Nature Conservancy
The Wilderness Society
Theodore Roosevelt Conservation Partnership
Tobacco Valley Resource Group
Tobacco Valley Study Group
Treasure State Alliance
Trout Unlimited
Troy & Libby Snowmobile Clubs
Vital Ground Foundation
Western Environmental Trade Assn
Western Land Exchange Project
Western Mining Action Project
Western MT Bldg and Construction Trades Council
Western MT Building Trades
Wildlands CPR
Winter Riders Inc.
Winter Wildlands Alliance
Wyoming Wilderness Assn
Yaak Rod and Gun Club
Yaak Valley Forest Council

Businesses

10 Lakes Forestry and Excavation
1st Natl. Bank
AAAuto Mobile Car Doctor
Associated Logging Contractors, Inc.
Avista Corp.
BKS Environmental Associates, Inc.
Boliden Resources, Inc.
C.K. Presley & Associates, Inc.
Calvert Ranch
Camp, Dresser & McKee, Inc.
Canavan Logging
CBS News 60 Minutes
Cecil Goff Clipping
Cedapine Veneer Inc.
Chalkstream Capital Group
Charlie Carvey Logging
Citizens Telecom of MT
Columbia Helicopters Inc.
Cominco American Resources Inc.
Conservation Research and Management Consulting Services
Daily Interlake
Denning Printing
Diversified House Logs Inc.
Dresser Ind. Inc.
Edlund and Hayes
Environmental Strategies Inc.
Environomics Inc.
Erickson Air Crane Inc.
Eureka Rural Dev Partners
FH Stoltze Land and Lumber Co.
Flathead Electric Cooperative, Inc.
Franklin and Associates
Gaetz, Madden & Dunn
Genesis Inc.
Golden Sunlight Mines
Harding Lakes Ranch
Hecla Mining Co.
Hershberger's Treasure Mountain Fence
Highland Logging
Highland Resources, Inc.
Hollingsworth Ranch LLC
Jenson & Mills
Kentucky Heartwood
Kovar Properties LLC
KPAX-TV
Lance and Posten
Libby Creek Ventures

Libby Placer Mining Company
Lightning Excavating
Line Layers Inc
Linehan Outfitting Co.
Lisa Bay Planning and Resource Mgmt.
Little Bitterroot Special Services, Inc.
Louisiana Pacific Corp.
Mines Management Inc.
Minturn and Murnane
Monenco Consultants, Ltd.
Montanian Newspaper
N.A. Degerstrom, Inc.
Neff & Nayes
Nerco Exploration Co.
Noranda Inc Falconbridge Ltd.
Noranda Minerals Corp.
Northern Lights, Inc.
Orvana Resources Corp.
Owens and Hurst Lumber Co Inc.
Payne Machinery, Inc.
Plum Creek Marketing
Plum Creek Timber Co.
PRC Environmental Management, Inc.
Raviv & Patricio Associates, Inc.
Revett Silver Co.
Ridin P Ranch
Riley Creek Lumber
Rovig Minerals, Inc.
Rusher Air Conditioning
Sanders County Ledger
Silver Bow Outfitters
Silver Butte Ranch Corp.
Smurfit Stone Container Corp.
Spokesman Review
St. John's Lutheran Hospital
Stein and Preston
Stimson Lumber Co.
T B C Timber Inc.
T I M B E R
Tellavector Pacific
The Missoulian
The Montanian
Timber Tech, Inc.
Timberline Auto Center, Inc.
Tungsten Holdings Inc
Westech, Inc.
Western Economic Service
Western News
Western Resources Dev. Co.
Western Woods
Westmont Mining Inc.
W-I Forest Products

4.2.1.3 Individuals

Robert and Elaine Abel
Tony Adkins
John and Susan Ague
Stuart Allen
Thomas J. Allen, P.E.
Matthew Ames
Deborah Amidaneau
Ronald Amos
Eskil Anderson
Maury Anderson
Bill Armstrong, Jr.
Richard Artley
Briggs and Alice Austin
Tim Babcock
Ed W. Baker
Graeme Baker
Howard Bakke
Kathleen Ball
Dawn Ballou
Boyd Banks
Mike Banks
Don & Lisa Bargo
John Basham
Rick Bass
Brian L. Bauer
George Bauer
Skip Baxter
Christopher Bean
Mike and Deborah Beaty
Greg Bechle
John and Teddye Beebe
John L Beebe
Royce Bentley
Douglas and Marcia Berg
G.T. Berlin
Jeff Berman
Almarie Bernardy
David T. Berner
Gene Bernofsky
Phillip and Dawn Bertellotti
Jayant Bhandari
Phillip K. Bigelow
Merlin Bingham
Bill Bischoff
Brad Black, M.D.
David T. Blackburn
Joachim & Charlotte Bluhm
Arthur D. and Dallas T. Bollinger
Gary Bain Bonnie Riedel
Robert Bothamley
Jean and Janet Bourdeau
Norm Bourg
Frank W. Bowdish
Rosalee Braaten
Allen & Juanita Brabham
Tom Branagan
Jamie Brebner
Wade Bristol
Joseph and Brenda Brodmerkle
William T. Brogoitti
Chris Broili
Jack Brott
Jim Brousseau
Chuck Brown
Jay Brown
Jerry Brown
Larry Brown
Tim Brown
Randy Buckner
Wiley Buckner
Allen Burley
Gene and Ruth Bushnell
Mr. & Mrs. E.R. Buti
Dean Byrns
Cameron Calder
A. Buck Caloo
Eileen Carney
Loretta E. Carr
Charles Carroll
Cole H. Carter
John and Jo Cervi
Annette Chain
Nancy Chalgren
Greg Charlton
Earl E. Chase
Wayne A. Christenson
Chip Clark
Don Clark
Austin B. Clayton
Justin and Maria Clemons
Amy M. Cleveland
Jane Cline
Robert R. and Margaret L. Cluzen
Brian L. Cody
Robert B. Cody
Mike Collier
Roger E. Combs

Jessica Conrad
Jack Costanza
Jim Costello
L Coverson
John and Margaret Craig
Bobbi Jo Wilson Cronick
Richard Crouse
Ed Croymons
Frank Cuff
Barry Curran
William & Eve James Dan & Becky James
Clifford E. Dare
James E. Davidson
James Davis
Stanley Davis
Roger and Nancy Fay Davy
Pursi Dea
James Dean
Pierson Dean
Rick Deangelo
John and Linda Decarlo
Gene Decker
Clinton E. Degenhart
Ron Denowh
Ruthetta Dentz
Jack O. and Debra K. DeShazer
L. Destramps
Sherry Devlin
Barry N. Dexter
Gary Disney
Gordon Disney
Howard Disney
Larry Disney
Lee and Harry Disney
J.D. Dixon
David Domino
William Gross Donald Ingraham
Andy Dorrington
Charles B. Doten
Bryand and Jane Dunnivant
Craig Eaton
Dean Eaton
Charley & Maxine Eggleston
Donna Eggleston
Ed Eggleston
Jack and Cheryl Ehmann
James Eliskovich
Joe Elliott
Richard H. Ellis
Don and Christi Ellwood
Ginny Emerson
Celeste Engel
Don Engel
John Erhard
William Ericksmoen
Debra Erickson
Terry & Gerri Erskine
James Duane Mark Eugene Ague
Judy Evans
Stan Evans
George and Beverley Faria
William Faulkner
Derek & Susan Feeback
Terry Feldman
Matthew Fennessy
Mark Fennessy, Atty.
J.F. Fennessy, Jr.
William Fetters
James Fifield
Wayne Finch
James Finlay
Glowdena Finnigan % Carmen Groff
Robert Flansaas
Cameron O. Flint
Annie Fontenot
Jeffery and Leslie Forster
Phil Fortier
Edward L. Foss
Fess Foster
Cheryl Fox
Rhonda Francis
Dennis Frank
Jan Fraser
Maria Fraser
Robert W. Fraser
Harvey Frederickson
Daniel Funsch
Raymond and Judy Gendron
Ann German
Leo Giacometto
Glenda Gibbs
Joseph and Shannan Ginnaty
Hayden Glenn
Ralph Glidden
Karlheinz Goerken
Daniel R. Gogen
Earl Goyen
Lenore Goyen
Stuart Green
Ruscyk Green Little
Douglas & Susan Griffiths
Frank C. Griner
Robert Gruber
Roger and Keammoe Guches
Bob Guilfoyle
Steve Gunderson
Elizabeth Gupton
Jack W. Gustavel
Daryl Hagseth
Newton Haleblian
Dave Hall
Jim Hammons
John and Lynn Hancock
Brian & Zoe Ann Hanley
Jim Hanley
William R. and Rita L. Hanley
Barry Hansen
Barbara Hanson
Edward Hanson
Charles and Kathleen Harpole
Dwight L. Harris
Rebecca Harrison
Theresa Harrison
Wayne Hartly
Wayne Hartmann
Kenneth and Susan Haugen
Don L. Hawkins
Bruce Hayden
Brent L. Heath
Susan Hegarty
Art Helbling
Bob Hemming
Janet Henderson
Melvin Hendrick
Cesar Hernandez
Hannah and Shilah Hernandez
Christian A. Hesse
Pat Hettinger
Ron Higgins
Rick and Sandy Hildebrand
Ed Hill
Gene Hogan
Bob Holiday
John Holt
John Hossack
Russ Hudson
Jerry Hudspeth
Maurice J. Huisentruit
Buster Hunsaker
Russell Hurley
Joe E. Huston
Judith Hutchins
Chris Hyle
Donald Ingraham
Joseph and Mary Iovino
Randy Ivans
Carolann Jackson
David and Jewell Jameson

Edwin W. Jewell
Al Johnson
Chris and Renee Johnson
E.A. Johnson
James B. Johnson
Steve Johnson
Tony and Cindy Johnson
Cedron Jones
Bud Journey
Terry Kaiser
Sean and Rory Kane
Crash Karuzas
M.A. Kaufman
Bill Keis
Robert Snell Kendra Hamel
Richard Kenelty
Dale and Karen Kerkvliet
Don Kern
Ron and Carol Kern
Steve Ketchem
Daniel and Nancy Khoury
Tom Kilgore
Kate Kimball
Scott I. Klukos
Helen M. Knight
Thomas Knowles
Randall and Lisa Koble
Edward Kohler
Jeffery and Lisa Koskela
James Kraft
Richard A. Kulh
Ray & Sharon Kuntz
George and Vicki Lacy
Mark Laffoon
Norman A. Lamb
Gary A. Langley
Brousseau Langton
Dan Larson
Sharon Larson
Mark Lathrop
Wade Lee
Paul and Linda Leimbach
Eric and Barbara Lepak
Peter Lesica
Steve Lethrud
Ed Levert
Marvin and Marsha Levert
Steven H. and R. Christine Lewis
Chris Lind
Kendra Lind
Cliff Linster
Peter Lintern
Scott and Holly Lucsher
J. & Geneva Lybyer
Jon Lykens
Dave and Debbie Lyman
Ron and Shirley MacDonald
Ben Mallia
Elwin Lee & Bonnie M. Manicke
Forrest R. and Atlanta M. Manicke
Harold and Elaine Manicke
Kenneth L. and Lorraine Manicke
Royce Manicke
Winston V. and Rose Manicke
R.C. Marozzo
Norman D. Martensen
William Whitmore & Martha Christine Archer
Dan King and Mary Ann Waylett
Mary Bradshaw and Mary Stranahan
Thomas J. Matilas
Tom Matthews
Leo and June Maxwell
John McBridge
Robert McCallum
Mike McCann
Earl D. McCartney, CPA
Douglas and Lucy McCoy
Richard B. McCoy
Bryan and Sandra McDougall
Rod McElwain
John McKay
Lee McKinney
William McKinney
Pat McLeud
Mark & June McMahon
Larry McMaster
Gregory McN.French
Ed McNew
Jim McRell
Tim and Amy Metzger
Dennis Micklon
Dorothy Miller
S. Miller
Clint Mills
Mick Mills
Robert and Ladonna Monk
Wally Moreau
Jim R. Morey
A. Morgan
Bruce Morris
J.A. Morris
Jim Morris
Glenn & Helen Mueller
Mike and Doris Munro
Ken Munski
W.O. Murphy
Hele Anne Myers
Howard Myers
Bogdan Nedelescu
George Neils
Frank A. & Jenny Nelson
Sandy Nield
Ed and Gloria Nixon
John and Anita Norris
Laurence J. & Leslie Norry
Dan Nosler
Family Nussbaum
Bill O'Brien
Dan and Kathy O'Brien
John O'Brien
George & Eve Oldham
Ron Olfert
Nicholas E. Oltean
Charlene O'Neil
Charles H. O'Neil
David and Glenda Orr
Ted Pacheco
A.J. & M.R. Pajas
Andrew Parker
Doug Parker
John & Norma Parker
Ron & Sharon Parker
T.G. Patterson
Michael Pattie
Candi Payton
Mark P. Pearson
Mark Pearson
Othel and Marcia Pearson
Mike and Heidy Pelech Switzer
Henning and Suzanne Penttila
Greg Peterson
Ken Peterson
George Pettit
G.W. Phillion
Mike Phillips
Gary Phoenix
Bill Prause
Gary Price
Russell R. Price
Jay Prostrollo
Art Purdy
C. Phillips Purdy, Jr.
Antonio Manicke R and M Manicke Domier
Al and Marbie Randall

Jim Rathbun
Thomas K. & Penny Ray
Henry Reatz
Gene Reckin
Jim R. Redman
Kippy Redman
M.D. Regan
Thomas D. Rennebaum
Barbara D. Rhodes
Robert L. Richardson
Darlene Riley
Matty and Margaret Rimstad
Susan Rinehart
Steve Risley
Roger L. Roberson, Jr.
Gary Robert
Myrtle Robertson
Michael and Cheryl Roediger
Dennis and Elna Rooney
Charles Roseburg
Bruce and Barbara Ross
George and Bonita Rouse
George F. and George W. Rouse
Steven Ruffatto
Michael Ruskey
James A. Sands
Greg Sauer
Nancy Savage
Patrick W. Savage
Al Sawitke
C.A. Saxton
Dario and Mary Ann Scarabosio
Harald Scharnhorst
Charlie Schepp
Eberhard A. Schmidt
Paul L. Schmidt
James and Erin Schmitt
Nester and Arlene Schmitt
Harry and Sue Schneider
James and Alice Schneider
James C. and Vicki L. Schneider
Earl Schulke
Otto L. and Robyn Schumacher
Mathias Schwarz
Denis J. Schwenk
Rick Schwien
Jess Sedler
James C. Sever
Susan Shane
Randy Sharp
Harvey K., Ethel G., and Mary Jean Shelley
Roger Shields
Judith K. Shiffler
John and Deena Shotzberger
Bette Shull
Wanda Sidmore
M. J. Simmins
Alan Skranak
Henry Skranak
James Skranak
Harold C. Sletton
P. Sloan
Don Smart
Jeremy Smith
Lary and Leanna Smith
Max Smith
Timothy C. Smith
Sherry Smith Turstee
Andy Snyder
Colleen Snyder
Emily J. Snyder
John and Mary Solem
Ken Sorensen
Michael and Karol Spas-Otte
Robert & Jean Spooner
Rick and Michael Spowart
Bob and Sara Lou Springer
John and Gaynelle Stamm
Edward G. Stamy
Barry Stang
Ellis Stapley
Richard and Linda Stehlik
Bob Stein
Jackie Stephens
Scott Stephenson
William Randy Steven Cady
Robert Stonehocker
Donna J. Strachocki
Elizabeth Breyl Strain
S.Z. Streeter
Al & Donna Stringer
Deb Strohmyer
Fred Sturgess
Neil Sullivan
Dawn Svalberg
Larry Sverdrup
Paul Svrcek
John R. Swanson
Bruce Switzer
Wes Tangen
Bob Taylor
Doris Taylor
Robert and Chris Taylor
Tim Thier
Rick Thompson
J.R. Tindell
Douglas and Pamela Tobin
Chip and Margie Todd
Robert Todd
Carol Tonner
Phil Tosh
Joe Trebelcock
Bart Triesch
Tom Troy
Colleen Tschakert
Steven R. Tucker
Jack Tuholske
Sipe Wisher Tumey
Kent Turner, Jr.
Robert Uithof
Frank Van Vlymen
Mona Vanek
Michael and Ruth Ann Vanworth-Rogers
Ben Vaughn
Michael and Eileen Vinion
Mr. & Mrs. Dave Waatt
Eleanor I. Wade
Dr. A. W. Walton
Paul and Ann Warrington
Daniel G. Waters
Johnette Watkins
Harry K. and Nellie Waylett
Geneva Manicke Webster
Michael E. Webster
Susan Weller
Joe Welts
D.H. & B.B. Westfall
April White
Mark J. White
Robert and Dorothy Ann White
Keith Whiting
Don & Lena Whitson
O.J. Wick
Don Wilkins
Dan and Cindy Williams
Noel Williams
Charles Wilson
George R. Wilson
Randy and Janet Wilson
Dave Winn
Denver Winslow
Dewayne Winthold
R.D. Wirth
Albert and Vestina Withee
Albert F. and Vestina T. Withee
Connie Wood
Thomas J. Wood
Charles F. Woods
Mr. & Mrs. Robert Woods

Holly Wright
Ted Yarbrough
Delphine R. and Leon J. Yates
Delphine Yates
Arthur D. Zierold
Bob Zimmerman
Mary Ann Zolezzi
Edward and Dianna Zucker

Chapter 5. Index

230-kV transmission line, 2, 5, 6, 10, 15, 24, 25, 26, 45, 53, 159, 160, 168, 170, 171, 186, 191, 205, 212, 213, 220, 476, 524, 525, 558, 585, 586, 587, 639, 640, 641, 797, 912, 930, 932
310 Permit, 25
401 Certification, 24
Access road construction, 168, 173, 175, 182, 185, 207, 477, 537, 541, 542, 615, 623, 879
Access road use, 95
Acid deposition, 227, 239, 496
Acid generation, 27, 48, 98, 103, 345, 365, 371, 373, 374, 375, 376, 378, 379, 381, 383, 384, 385, 387, 388, 605
Acid rock drainage, 92, 149, 150, 173, 181, 183, 373, 374, 375, 378, 379, 381, 386, 388
Adit, 4, 5, 6, 8, 32, 33, 35, 36, 38, 39, 41, 42, 44, 45, 47, 48, 49, 53, 54, 58, 59, 60, 61, 62, 63, 64, 66, 69, 71, 72, 76, 78, 88, 92, 93, 94, 95, 96, 98, 99, 100, 101, 108, 109, 112, 113, 114, 116, 118, 119, 124, 125, 129, 133, 135, 136, 138, 139, 147, 151, 153, 154, 156, 159, 160, 192, 193, 194, 208, 211, 220, 221, 225, 227, 228, 229, 231, 234, 236, 237, 238, 254, 269, 287, 294, 300, 301, 303, 306, 307, 308, 309, 311, 312, 315, 318, 321, 327, 342, 352, 354, 355, 356, 357, 373, 379, 380, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 395, 396, 397, 400, 415, 416, 419, 421, 422, 426, 427, 428, 430, 432, 433, 442, 444, 446, 460, 464, 467, 470, 471, 476, 479, 482, 485, 487, 489, 490, 500, 501, 505, 509, 513, 520, 526, 531, 532, 534, 535, 536, 545, 550, 551, 553, 554, 562, 563, 565, 566, 582, 597, 598, 599, 600, 602, 606, 607, 609, 610, 612, 617, 620, 623, 625, 628, 631, 635, 636, 637, 638, 642, 643, 649, 652, 653, 654, 658, 659, 660, 682, 683, 685, 687, 688, 691, 707, 708, 709, 710, 720, 724, 771, 772, 775, 776, 777, 784, 820, 828, 830, 844, 845, 860, 890, 893, 894, 895, 905, 908
Air quality, 5, 17, 19, 21, 24, 29, 44, 65, 82, 94, 124, 191, 212, 225, 226, 227, 229, 230, 231, 232, 234, 235, 237, 238, 239, 240, 450, 485, 496, 527, 680
Air quality related values, 225, 226, 235, 239
Alluvial soils, 598, 600, 601
Alpine characteristic landscape, 559, 560
Alpine glacial soils, 598, 599
Ambient water quality, 4, 413, 480, 488
Amendment, 8, 16, 20, 39, 91, 122, 145, 160, 185, 186, 188, 190, 229, 414, 477, 483, 515, 524, 531, 532, 535, 537, 542, 543, 569, 571, 603, 606, 618, 619, 626, 631, 664, 665, 680, 703, 734, 736, 738, 743, 747, 757, 759, 763, 770, 790, 817, 826, 831, 884, 885, 888, 933, 934
Analysis area lakes, 305, 306, 316, 317, 318, 320, 326, 327, 328
Antimony, 157, 226, 414, 418, 427, 437, 441, 446, 481, 484, 485, 487, 493, 495, 502, 504, 506, 511
Aquatic insects, 79, 310, 312
Arsenic, 83, 226, 233, 374, 379, 382, 384, 414, 427, 481, 484, 493, 495, 496, 499, 502, 506
Backfilling, 51, 71, 106, 169, 195, 201, 202, 203, 204, 205, 211, 217, 380, 383, 396
Bald eagle, 178, 726, 792, 793, 794, 795, 796, 797, 798, 799, 911, 912, 913, 914
Barriers to fish passage, 41, 69, 98, 189, 249, 251, 257, 266, 267, 279, 286, 289, 290, 291, 294, 296, 300, 306, 307, 313, 314, 315, 316, 317, 318, 350, 509, 623, 696, 727, 736, 740, 748, 755, 756, 758, 759, 760, 761, 762, 763, 776, 777, 844, 848, 851, 854, 855, 857, 858, 916, 923
Base flow, 250, 254, 264, 306, 307, 308, 309, 313, 314, 315, 316, 317, 321, 322, 336, 350, 416, 417, 421, 422, 428, 430,

431, 432, 433, 434, 442, 445, 446, 447, 448, 450, 451, 452, 455, 456, 458, 461, 462, 466, 467, 469, 470, 472, 473, 474, 476, 478, 500, 508
Bear Creek Road, 7, 33, 37, 42, 44, 45, 46, 53, 56, 67, 69, 75, 88, 96, 100, 115, 116, 118, 120, 151, 154, 156, 205, 234, 263, 320, 322, 325, 339, 340, 341, 342, 523, 524, 526, 531, 532, 535, 544, 545, 548, 549, 550, 552, 553, 554, 634, 635, 636, 643, 645, 646, 647, 649, 650, 651, 652, 653, 664, 695, 754, 755, 766, 807, 808, 812, 814, 844, 850, 851, 853, 889, 890, 893, 894, 905, 906, 918, 923
Bedrock, 6, 50, 59, 63, 71, 93, 94, 100, 106, 113, 151, 169, 231, 296, 306, 307, 366, 368, 369, 371, 372, 395, 396, 413, 415, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 428, 429, 431, 432, 434, 435, 439, 445, 446, 452, 453, 454, 455, 458, 460, 461, 462, 474, 486, 490, 496, 500, 505
Best available control technology, 237
Best management practices, 65, 66, 113, 123, 129, 168, 222, 223, 302, 303, 305, 313, 319, 325, 328, 331, 332, 334, 335, 337, 339, 340, 347, 476, 486, 507, 513, 514, 517, 596, 602, 603, 608, 613, 615, 623, 625, 628, 629, 630, 642, 654, 680, 688, 689, 695, 698, 699, 702, 807, 808, 809, 835, 836
Black-backed woodpecker, 147, 148, 799, 800, 801, 803, 804, 806, 807, 910, 911, 912, 913, 914, 924, 926, 927, 928, 929, 931, 932, 934
Blasting, 41, 147, 169, 217, 222, 365, 373, 375, 386, 387, 430, 489, 507, 636, 720, 724, 771, 776, 777, 784, 789, 791, 820, 823, 828, 830, 844, 845, 846
Board of Health and Environmental Sciences Order, 2, 4, 19, 74, 75, 114, 120, 190, 255, 256, 310, 311, 312, 321, 413, 414, 437, 441, 444, 468, 480, 481, 482, 485, 487, 502, 503, 504, 505, 510, 511, 517
Cabinet Mountain Wilderness, 2, 3, 6, 7, 8, 12, 27, 28, 44, 47, 108, 129, 130, 189, 192, 194, 207, 208, 218, 220, 225, 226, 227, 229, 230, 231, 233, 235, 236, 237, 238, 239, 240, 267, 272, 280, 296, 301, 307, 322, 369, 372, 393, 424, 431, 449, 454, 455, 456, 460, 461, 462, 467, 470, 496, 497, 500, 527, 546, 548, 549, 551, 553, 554, 556, 559, 560, 562, 563, 564, 565, 567, 568, 569, 635, 636, 637, 689, 704, 705, 706, 707, 708, 710, 711, 777, 840, 849, 878, 883, 889
Cadmium, 79, 83, 226, 233, 294, 382, 387, 414, 426, 427, 437, 441, 481, 484, 488, 491, 493, 495, 499, 502, 506
Camping, 546, 548, 549, 550, 551, 557, 575, 577
Canada lynx, 219, 847, 884, 888, 890, 907
Carbon monoxide, 224, 226, 229, 230, 231
Certificate, 1, 4, 5, 6, 8, 11, 16, 17, 18, 24, 44, 159, 187, 205, 449, 642, 714, 727
Channel A and B, 50, 390, 459, 466, 469, 474, 475, 510, 611
Chromium, 4, 190, 226, 233, 381, 413, 414, 426, 427, 480, 481, 484, 491, 493, 495, 496, 499, 502, 506
Class I area, 225, 226, 227, 235
Class I increment, 233, 237
Clean Water Act, 9, 14, 15, 16, 23, 24, 30, 187, 483, 690, 701, 702, 747, 768, 808, 809
Climate, 61, 228, 415, 632, 657
Closure, 71, 81
Coeur d'Alene salamander, 807, 808, 809
Colluvial/glacial soils, 98, 598, 600, 601, 622
Coniferous forest, 96, 268, 496, 617, 618, 619, 623, 625, 656, 657, 658, 659, 660, 661, 662, 663, 671, 683, 771, 772, 799, 803, 804, 809, 812, 813, 814, 815, 816, 818, 820, 822, 823, 824, 825, 827, 828, 830, 832, 834, 837, 910, 911, 913, 916, 926, 927, 928, 929, 930, 931, 932, 933, 934
Continental glacial soils, 598, 599
Conveyor, 32, 47, 55, 56, 65, 99, 193, 194
Copper, 1, 3, 4, 7, 9, 10, 11, 55, 61, 83, 187, 190, 191, 192, 219, 226, 242, 256, 268, 282, 294, 311, 312, 323, 326, 366, 368, 369, 370, 372, 373, 375, 376, 378, 379, 380, 381, 382, 385, 386, 387, 393, 397, 413, 414, 426, 427, 437, 441, 480, 481, 482, 484, 485, 491, 493, 495, 496, 499,

502, 503, 504, 506, 511, 574, 591, 592, 605, 629, 827
Core grizzly bear habitat, 79, 189, 337, 857, 865, 867, 875, 882
Cover/forage ratios, 727, 728, 748, 749, 753
Critical habitat, 13, 14, 23, 27, 124, 159, 189, 245, 284, 287, 300, 316, 323, 327, 331, 333, 334, 335, 337, 348, 350, 696, 888, 890, 907
Cross-country skiing, 546, 549, 550
Down wood habitat, 28, 163, 678, 714, 715, 716, 717, 718, 719, 720, 721, 722, 724, 725, 778, 779, 783, 785, 789, 790, 791, 800, 806, 816, 825, 826, 830, 833, 835, 836, 838, 845, 886, 889, 890, 893, 897, 898, 899, 906, 915, 933
Drawdown, 82, 254, 321, 417, 428, 429, 430, 433, 434, 442, 446, 447, 448, 460, 462, 470, 505, 519, 521
Dust control, 56, 65, 521, 650
East Fork Bull River, 35, 40, 41, 109, 129, 130, 159, 208, 218, 248, 249, 250, 252, 254, 260, 265, 267, 269, 279, 280, 281, 282, 284, 285, 286, 287, 288, 289, 290, 292, 293, 294, 295, 296, 297, 299, 300, 301, 302, 309, 310, 313, 314, 315, 316, 317, 321, 322, 323, 324, 325, 326, 327, 336, 349, 350, 431, 432, 433, 434, 442, 445, 447, 449, 450, 452, 454, 455, 456, 457, 461, 467, 472, 478, 484, 485, 491, 496, 498, 505, 519, 520, 521, 696
East Fork Rock Creek, 6, 35, 40, 109, 142, 207, 210, 245, 252, 260, 264, 265, 270, 271, 272, 273, 278, 279, 282, 284, 285, 287, 288, 289, 294, 299, 300, 307, 314, 315, 316, 319, 321, 322, 323, 324, 325, 327, 349, 350, 416, 417, 419, 422, 424, 426, 431, 432, 434, 435, 442, 446, 447, 451, 452, 454, 457, 458, 461, 462, 467, 472, 478, 485, 496, 498, 519, 520, 521
Effluent limitations guidelines, 61, 100, 467, 469, 472, 473, 475, 476, 482, 508
Electrical and magnetic fields, 184, 237, 551, 553, 633, 634, 640, 642, 707, 709
Elk, 29, 163, 178, 200, 201, 530, 548, 658, 704, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 741, 742, 743, 744, 745, 746, 747, 749, 751, 759, 761, 767, 791, 832, 834, 837, 848, 849, 850, 851, 852, 853, 854, 855, 863, 910, 911, 914, 916, 917, 920, 921, 923, 924, 934
Emissions, 16, 19, 24, 65, 66, 83, 224, 225, 226, 227, 228, 231, 233, 234, 236, 237, 238, 239
Employment, 7, 10, 20, 70, 91, 135, 220, 571, 572, 574, 575, 576, 582, 583, 584, 585, 586, 587, 588, 593, 594, 595
Endangered Species Act, 13, 14, 218, 219, 245, 246, 337, 527, 681, 713, 847, 857, 859, 861, 875, 882
Environmental justice, 935
Fish loss, 41, 253, 326
Fish passage, 37, 116, 253, 257, 267, 272, 279, 286, 289, 290, 294, 301, 313, 314, 317, 322, 325, 326, 327, 336, 340, 341, 342, 477, 515, 695
Fish population survey, 252
Fisher River, 133, 134, 159, 173, 174, 184, 185, 189, 206, 213, 242, 249, 251, 252, 265, 267, 270, 271, 280, 281, 284, 285, 286, 288, 289, 290, 291, 292, 293, 294, 296, 297, 298, 299, 300, 319, 327, 328, 329, 331, 332, 333, 335, 365, 368, 414, 449, 450, 452, 455, 456, 476, 477, 483, 484, 513, 515, 516, 517, 525, 526, 536, 541, 542, 548, 574, 577, 598, 613, 615, 616, 630, 635, 638, 639, 658, 671, 676, 678, 686, 692, 693, 730, 731, 735, 737, 738, 739, 743, 744, 751, 759, 760, 762, 766, 767, 780, 785, 786, 787, 795, 796, 797, 798, 829, 849, 863, 868, 871, 872, 874, 879, 912, 917, 920, 923
Fisheries mitigation, 38, 87, 88, 95, 97, 148, 157, 159, 305, 313, 315, 318, 319, 322, 326, 333, 334, 335, 348, 506, 507, 551, 694, 696, 832, 835
Fishing, 87, 159, 242, 243, 246, 283, 545, 546, 548, 549, 550, 552, 553, 554, 557, 575, 577, 581, 582, 705, 706
Flammulated owl, 147, 148, 665, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 910, 911, 912, 913, 914
Flathead Electrical Cooperative, 53, 160, 172
Floodplain, 20, 21, 25, 110, 152, 153, 168, 176, 188, 205, 209, 247, 269, 283, 296, 297, 298, 302, 328, 332, 341, 368, 391,

449, 450, 452, 453, 459, 463, 470, 474, 476, 477, 506, 507, 510, 512, 598, 608, 609, 611, 612
Flotation, 7, 55, 56, 61, 201, 380, 381, 382, 449, 482
Forage openings, 727, 728, 731, 737, 738, 739, 748, 749, 750, 751, 757, 760, 761, 762
Forest plan amendment, 8, 146, 160, 188, 543, 596
Forest Service sensitive species, 288, 713
Foundation, 50, 51, 52, 81, 82, 101, 103, 104, 105, 106, 107, 169, 171, 208, 210, 213, 402, 404, 405, 406, 407, 410, 436, 610, 612, 705
Fugitive dust, 55, 56, 58, 59, 64, 65, 66, 77, 81, 82, 83, 112, 114, 233, 234, 236, 237, 239, 490, 506, 514, 521, 570, 650, 725, 887
FWP-Plum Creek Conservation Easement, 22, 25, 42, 89, 91, 135, 136, 137, 142, 143, 145, 206, 219, 221, 337, 523, 526, 536, 538, 541, 542, 543, 548, 866, 869, 878
Gaseous pollutants, 238
Generator, 53, 227, 234, 236, 636
Glaciolacustrine soils, 38, 97, 98, 395, 598, 601, 604, 609, 610, 611, 612
Gold panning, 85, 86, 127, 158, 193, 537, 541, 542, 543, 546, 549, 551, 553, 554, 555, 556, 557, 638, 639, 701, 827
Gray wolf, 29, 726, 847, 848, 850, 851, 852, 853, 854, 855
Grizzly bear, 28, 42, 77, 88, 89, 90, 91, 95, 119, 132, 133, 134, 135, 136, 137, 138, 139, 142, 143, 144, 145, 146, 149, 150, 156, 162, 165, 173, 174, 175, 180, 181, 182, 183, 184, 185, 186, 188, 189, 192, 195, 196, 200, 201, 208, 218, 219, 220, 221, 524, 527, 528, 530, 531, 532, 535, 536, 544, 557, 648, 651, 652, 662, 675, 676, 677, 678, 689, 704, 706, 726, 727, 728, 731, 734, 736, 740, 743, 748, 749, 754, 755, 756, 759, 763, 766, 771, 776, 783, 784, 785, 786, 790, 816, 827, 828, 830, 840, 844, 845, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 877, 878, 879, 880, 881, 883, 884, 891, 893, 896, 897, 898, 899, 903, 904, 907, 908, 916, 918, 920, 923, 924
Grizzly bear mitigation plan, 727, 734, 740, 748, 754, 766, 857, 865, 916
Ground water levels, 78, 125, 126, 128, 309, 410, 428, 430, 432, 436, 442, 443, 445, 446, 467, 520, 521, 695
Ground water quality, 16, 19, 92, 190, 255, 365, 415, 418, 426, 428, 434, 436, 440, 443, 444, 448, 468, 480, 488, 490, 505
Habitat condition index, 260, 263, 264
Habitat connectivity, 674, 676, 783, 784, 785, 786, 885, 886, 887, 889, 891, 896, 898, 903
Habitat effectiveness, 28, 42, 132, 135, 137, 138, 165, 196, 200, 201, 220, 530, 727, 728, 730, 731, 733, 734, 735, 736, 738, 740, 742, 743, 744, 745, 746, 791, 826, 849, 857, 863, 866, 869, 870, 874, 875, 880, 881, 882, 884, 907, 908, 916, 917, 921, 922, 923
Habitat survey, 40, 129, 130, 152, 249, 250, 260, 265, 290, 292, 295, 298
Hard Rock Mining Impact Act, 20, 25, 571
Hard Rock Mining Impact Plan, 16, 20, 91, 127, 157, 571
Hard Rock Operating Permit, 1, 4, 5, 7, 8, 17, 24, 32, 44, 51, 55, 58, 62, 80, 93, 109, 114, 132, 150, 159, 225, 231, 237, 300, 327, 343, 345, 356, 373, 389, 392, 395, 400, 401, 428, 460, 476, 500, 513, 520, 531, 536, 550, 554, 562, 566, 582, 612, 620, 628, 638, 652, 654, 660, 683, 688
Hazardous air pollutant, 224, 227, 233, 234, 581
Heidelberg Adit, 3, 372, 416, 426, 428, 446
Hiking, 118, 218, 546, 548, 550, 551, 554, 557, 575, 577, 705, 706
Historic property, 19, 351, 362
Housing, 135, 142, 283, 572, 575, 578, 583, 589, 590, 595, 702, 878, 879, 884, 907
Howard Lake, 36, 87, 109, 159, 167, 178, 180, 181, 182, 183, 184, 274, 281, 283, 291, 357, 451, 455, 462, 542, 546, 548, 549, 551, 553, 554, 555, 556, 559, 561, 567, 568, 616, 638, 639, 827, 849, 888, 890, 900, 901, 905

Hunting, 90, 131, 218, 241, 242, 246, 353, 525, 545, 546, 548, 550, 551, 552, 554, 557, 575, 577, 581, 705, 706, 727, 728, 729, 731, 735, 737, 744, 745, 748, 749, 750, 751, 757, 758, 759, 760, 767, 916, 917
Hydraulic conductivity, 398, 415, 416, 417, 418, 419, 420, 421, 423, 424, 429, 432, 435, 438, 439, 440, 443, 448, 490
Hydrogeology, 125, 405, 415, 419, 420, 428, 431, 434, 454, 460, 461, 490
Impoundment stability, 394, 412
Income, 572, 574, 576, 583, 584, 585, 586, 587, 590, 592, 595, 935
Introduced species, 39, 121, 163, 623, 626, 627, 630, 657, 659, 660, 661, 662, 663, 664, 684, 687, 688, 689, 702
Inventoried roadless areas, 91, 92, 107, 189, 194, 196, 200, 201, 205, 206, 551, 703, 704, 706, 708, 709, 710, 711, 712, 849
Iron, 4, 9, 190, 213, 216, 268, 368, 370, 373, 374, 381, 382, 384, 385, 386, 387, 413, 414, 427, 437, 441, 480, 481, 484, 485, 491, 493, 495, 496, 499, 502, 503, 504, 506, 511, 604, 618, 925
Job, 70, 573, 585
Key habitats, 175, 188, 247, 675, 713, 714, 726, 727, 729, 732, 741, 748, 750, 752, 753, 756, 762, 764, 779, 783, 785, 789, 791, 806, 820, 821, 822, 823, 826, 828, 830, 831, 848, 889, 893, 897, 899
Key issues, 1, 26, 29
Kootenai Business Park, 7, 33, 45, 56, 223, 245, 596, 654
Kootenai Forest Plan, 8, 11, 12, 27, 29, 31, 70, 76, 146, 160, 185, 186, 188, 189, 190, 191, 240, 243, 246, 247, 248, 292, 346, 364, 451, 478, 480, 517, 521, 523, 524, 526, 527, 530, 531, 532, 535, 536, 537, 541, 542, 543, 545, 547, 557, 558, 569, 571, 594, 596, 621, 623, 627, 630, 643, 654, 656, 664, 665, 666, 667, 668, 669, 674, 675, 676, 677, 678, 680, 682, 684, 689, 702, 703, 704, 711, 713, 714, 715, 716, 717, 718, 720, 721, 722, 724, 725, 726, 727, 728, 729, 730, 732, 733, 734, 736, 738, 740, 741, 742, 743, 746, 747, 749, 751, 752, 754, 757, 759, 763, 764, 765, 769, 770, 779, 791, 798, 799, 806, 807, 808, 809, 816, 817, 825, 826, 827, 831, 839, 845, 848, 850, 856, 859, 861, 875, 882, 885, 890, 893, 894, 897, 899, 906, 909, 914, 915, 920, 921, 922, 923, 924, 933, 934
Lake levels, 27, 78, 126, 307, 309, 350, 429, 449, 450, 451, 454, 455, 460, 462, 470, 472, 478, 479, 486, 835, 839
Land Application Disposal, 4, 8, 27, 32, 33, 35, 37, 38, 41, 44, 45, 47, 48, 58, 59, 60, 61, 62, 63, 64, 65, 68, 69, 72, 74, 78, 80, 86, 91, 92, 96, 97, 100, 107, 112, 113, 114, 115, 117, 118, 119, 123, 127, 146, 148, 149, 151, 153, 155, 156, 158, 186, 187, 190, 205, 225, 254, 287, 301, 302, 303, 306, 308, 309, 312, 318, 321, 338, 343, 346, 347, 352, 372, 383, 387, 389, 390, 391, 413, 414, 415, 417, 418, 423, 426, 428, 434, 438, 439, 440, 441, 442, 444, 445, 446, 448, 451, 453, 460, 464, 465, 467, 468, 469, 470, 471, 472, 474, 486, 487, 488, 490, 491, 500, 501, 502, 503, 504, 505, 508, 509, 510, 511, 512, 513, 524, 532, 534, 535, 552, 553, 554, 558, 563, 565, 566, 596, 597, 599, 606, 607, 609, 610, 617, 618, 623, 628, 637, 638, 660, 674, 694, 696, 697, 708, 709, 754, 755, 756, 780, 783, 784, 800, 918, 919, 921, 934
Landslide, 31, 188, 247, 531, 643
Large woody debris, 38, 97, 130, 152, 175, 247, 250, 258, 259, 265, 266, 287, 295, 297, 457, 886
Law enforcement, 43, 89, 90, 132, 133, 134, 221, 578, 590, 847, 854, 855, 856, 862, 867, 868, 870, 871, 878, 879, 883
Lead, 1, 6, 10, 11, 14, 19, 26, 29, 30, 31, 35, 38, 44, 46, 48, 51, 54, 55, 58, 59, 61, 62, 70, 71, 76, 77, 78, 79, 83, 84, 85, 87, 88, 89, 91, 92, 93, 95, 97, 98, 101, 103, 108, 109, 110, 112, 113, 115, 118, 120, 121, 122, 123, 125, 127, 132, 143, 151, 152, 153, 159, 160, 161, 167, 168, 169, 171, 173, 174, 175, 181, 182, 183, 184, 185, 186, 187, 188, 190, 191, 192, 193, 194, 195, 196, 199, 201, 202, 203, 204, 205, 206, 207, 210, 211, 212, 213, 214, 224, 226, 229, 230, 231, 232, 234, 243, 256, 282, 293, 294, 339, 342, 343, 344, 345,

346, 348, 370, 371, 373, 379, 381, 382, 383, 385, 386, 387, 388, 391, 394, 396, 399, 401, 406, 414, 427, 435, 437, 441, 462, 467, 472, 481, 482, 483, 484, 488, 491, 493, 495, 499, 502, 506, 512, 524, 574, 592, 605, 609, 612, 613, 623, 625, 629, 635, 644, 653, 654, 671, 691, 695, 754, 755, 766, 895, 918, 923, 935

Libby Adit Water Treatment Plant, 32, 62, 63, 72, 92, 114, 115, 153, 215, 468, 471, 503, 506, 508, 510, 513, 586

Libby Creek, 4, 5, 6, 22, 32, 36, 37, 41, 44, 46, 49, 50, 60, 67, 68, 73, 75, 78, 79, 81, 85, 86, 87, 88, 91, 92, 94, 99, 103, 104, 107, 109, 113, 115, 116, 118, 119, 120, 127, 129, 130, 131, 140, 141, 149, 153, 154, 155, 158, 159, 174, 185, 188, 189, 191, 192, 193, 194, 196, 199, 205, 207, 208, 209, 212, 218, 221, 243, 245, 247, 248, 250, 251, 252, 253, 254, 255, 256, 257, 260, 262, 263, 264, 266, 267, 268, 269, 270, 271, 272, 274, 276, 277, 278, 281, 282, 283, 284, 285, 286, 287, 288, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 331, 332, 333, 334, 335, 339, 340, 341, 342, 348, 349, 350, 353, 357, 365, 366, 372, 388, 389, 390, 391, 395, 418, 421, 423, 424, 426, 431, 432, 435, 442, 443, 445, 446, 447, 449, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 479, 482, 483, 484, 486, 487, 490, 491, 496, 498, 499, 500, 506, 507, 508, 509, 510, 512, 513, 515, 516, 517, 519, 520, 521, 525, 526, 532, 535, 537, 541, 542, 543, 546, 548, 549, 550, 551, 553, 554, 555, 556, 557, 562, 577, 608, 610, 611, 612, 613, 615, 616, 630, 635, 636, 637, 638, 639, 642, 643, 644, 645, 647, 649, 650, 651, 653, 658, 663, 693, 695, 696, 701, 707, 708, 709, 710, 711, 751, 756, 772, 775, 776, 777, 795, 800, 807, 810, 812, 814, 827, 835, 839, 840, 841, 844, 850, 851, 853, 860, 870, 872, 873, 877, 878, 883, 889, 890, 894, 895, 905, 906, 917

Libby Lakes, 40, 230, 239, 249, 254, 281, 397, 429, 450, 451, 462, 470, 485, 496, 500, 548

Libby Loadout, 7, 33, 45, 56, 65, 205, 223, 224, 225, 233, 234, 238, 245, 596, 636, 637, 643, 644, 645, 656

Lincoln County, 21, 22, 25, 66, 67, 84, 91, 122, 134, 229, 347, 523, 526, 545, 546, 549, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 587, 588, 589, 590, 591, 592, 593, 594, 684, 685, 687, 705, 862, 871, 872, 873, 879

Line stringing, 161, 166, 168, 171, 180, 182, 185, 332, 334, 335, 628, 629, 638, 639, 652, 662, 721, 735, 736, 759, 761, 762, 773, 774, 775, 776, 777, 786, 789, 822, 823, 829, 830, 841, 842, 843, 844, 845, 852, 864, 866, 867, 869, 872, 873, 874, 879

Little Cherry Creek, 7, 15, 32, 34, 38, 39, 40, 41, 44, 45, 49, 50, 51, 52, 60, 62, 63, 64, 69, 73, 75, 78, 81, 85, 86, 87, 91, 93, 101, 102, 104, 113, 116, 120, 127, 129, 130, 149, 150, 151, 152, 153, 154, 156, 157, 158, 159, 160, 186, 190, 195, 199, 200, 201, 204, 205, 208, 209, 210, 224, 225, 228, 229, 237, 249, 250, 251, 252, 253, 254, 256, 257, 260, 263, 264, 267, 268, 272, 274, 275, 276, 277, 281, 287, 288, 291, 294, 295, 296, 301, 302, 304, 305, 306, 307, 308, 312, 313, 314, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 329, 337, 349, 352, 354, 355, 357, 365, 371, 372, 389, 390, 391, 392, 393, 394, 402, 404, 405, 408, 415, 417, 418, 423, 424, 426, 428, 435, 436, 439, 443, 444, 445, 446, 452, 453, 454, 456, 457, 458, 459, 460, 463, 464, 466, 469, 471, 472, 473, 474, 476, 479, 485, 491, 497, 498, 500, 503, 506, 507, 508, 510, 512, 518, 524, 525, 526, 531, 532, 535, 536, 548, 550, 551, 552, 557, 564, 566, 596, 598, 599, 600, 602, 605, 606, 608, 609, 610, 611, 612, 617, 620, 621, 622, 623, 627, 628, 631, 634, 636, 637, 638, 650, 653, 667, 674, 682, 683, 691, 692, 693, 695, 696, 699, 700, 701, 702,

707, 708, 709, 750, 756, 780, 783, 807, 812, 833, 877, 890, 894, 917, 925
Logging, 55, 297, 298, 300, 332, 340, 353, 354, 355, 358, 360, 362, 453, 537, 556, 574, 577, 603, 613, 614, 630, 638, 639, 686, 692, 693, 702, 864, 869
Macroinvertebrates, 2, 126, 249, 251, 252, 269, 270, 272, 303, 304, 308, 312, 322
Major Facility Siting Act, 1, 4, 10, 16, 17, 18, 24, 30, 31, 147, 187, 205, 206, 245, 449, 571, 596, 656, 665, 682, 713, 714, 726, 846, 909, 915
Manganese, 4, 157, 190, 256, 311, 374, 379, 381, 382, 384, 386, 387, 413, 414, 426, 427, 436, 437, 441, 444, 446, 480, 481, 484, 485, 493, 495, 496, 499, 502, 503, 504, 505, 506, 511, 512, 604, 618
Metal concentrations in fish, 256, 282, 301, 312, 325
Migratory Bird Treaty Act, 14, 792, 908, 909
Migratory birds, 14, 29, 42, 147, 165, 178, 690, 713, 792, 908, 909, 910, 911, 912, 913, 914, 915
Miller-West Fisher Vegetation Management Project, 222, 239, 364, 517, 525, 569, 577, 642, 654, 663, 678, 684, 702, 724, 744, 745, 746, 747, 768, 769, 770, 790, 806, 816, 825, 831, 838, 881, 883, 905, 906, 933
Milling, 7, 55, 56, 58, 79, 80, 215, 220, 237, 482, 486, 507, 634, 637
Mine drainage, 19, 62, 63, 64, 65, 114, 321, 373, 375, 393, 464, 465, 469, 471, 482, 485, 487, 501, 509
Modeling, 2, 6, 35, 93, 108, 109, 151, 226, 227, 229, 234, 235, 239, 322, 418, 435, 442, 445, 472, 505, 521, 810, 818, 840, 925
Montana Air Quality Permit, 224, 225, 227, 239
Montana Ambient Air Quality Standards, 224, 226, 229, 231, 233, 234, 237, 238, 239, 240, 680
Montana Environmental Policy Act, 1, 10, 16, 17, 30, 103, 187, 214
Montana Pollutant Discharge Elimination System, 5, 6, 16, 19, 24, 44, 59, 60, 61, 62, 72, 80, 94, 100, 113, 114, 115, 119, 215, 321, 380, 387, 389, 436, 438, 442, 444, 468, 469, 470, 471, 482, 485, 487, 489, 505, 508, 586
Montanore sub-deposits, 7, 369, 370, 371, 372, 373, 376, 378, 379, 383, 384, 385
Moose, 29, 163, 178, 200, 201, 530, 548, 706, 713, 731, 849, 915, 916, 917, 918, 919, 920, 921, 923, 924, 934
Mountain goat, 29, 41, 147, 704, 726, 770, 771, 772, 773, 774, 775, 776, 777, 778, 791, 910, 911, 914
Movement areas, 732, 741, 748, 752, 753, 756, 764, 766, 885, 890, 896, 898, 900, 903, 905, 916, 917, 921
National Ambient Air Quality Standards, 224, 226, 229, 231, 233, 234, 237, 238, 239, 240
National Environmental Policy Act, 1, 13, 17, 29, 30, 93, 103, 143, 187, 214, 216, 241, 242, 703
National Forest Management Act, 12, 13, 246, 656
National Historic Preservation Act, 13, 25, 148, 241, 351, 352, 362, 364
National Register of Historic Places, 19, 351, 354, 355, 356, 357, 358, 359, 362, 363, 364
Native species, 39, 76, 122, 128, 163, 348, 623, 626, 630, 660, 664, 687, 689, 894, 895
Nitrates, 4, 63, 78, 94, 114, 157, 190, 227, 230, 251, 255, 294, 309, 310, 321, 365, 373, 375, 380, 382, 384, 386, 387, 413, 414, 427, 437, 440, 441, 444, 446, 470, 480, 481, 484, 485, 487, 489, 493, 495, 496, 497, 499, 502, 503, 504, 506, 508, 509, 510, 511, 512
Nitrogen oxide, 224, 225, 226, 229, 230, 231, 232, 233, 234, 235, 238, 239
Nondegradation, 4, 16, 189, 190, 245, 255, 256, 310, 413, 441, 444, 480, 482, 483, 503, 510, 517
Nonnative species, 122, 277, 660
Noranda, 1, 3, 4, 5, 6, 7, 20, 51, 93, 114, 127, 151, 186, 187, 189, 190, 207, 208, 209, 210, 234, 242, 345, 352, 405, 413, 415, 427, 428, 430, 445, 446, 449, 480, 482, 484, 485, 487, 489, 503, 524, 596
Notice of Intent, 26, 343

Noxious weeds, 22, 23, 25, 40, 46, 77, 84, 87, 97, 121, 122, 123, 124, 128, 168, 171, 175, 176, 217, 341, 624, 626, 627, 629, 656, 657, 658, 663, 684, 685, 686, 687, 688, 689, 730
Noxon-Libby Transmission Line, 6, 15, 53, 159, 160, 191, 212, 213, 525, 661
Numerical model, 36, 108, 307, 309, 310, 336, 415, 416, 417, 419, 425, 428, 429, 430, 431, 432, 433, 434, 442, 446, 447, 450, 460, 461, 462, 467, 478, 490, 500, 501
Nutrients, 27, 39, 114, 158, 253, 255, 256, 268, 272, 278, 285, 291, 294, 301, 309, 310, 312, 316, 321, 322, 323, 325, 326, 375, 436, 442, 445, 491, 496, 501, 505, 603, 604, 615, 616, 617, 618, 619, 620, 621, 622, 626, 628, 629, 700, 718
Odor, 237, 414, 481
Old growth blocks, 668, 670, 674, 676, 677, 783, 784, 785, 786
Opacity, 65
Open burning, 20, 21, 25, 97
Open road density, 28, 186, 728, 730, 733, 734, 736, 738, 739, 740, 742, 743, 745, 746, 747, 748, 749, 750, 752, 754, 755, 756, 757, 759, 761, 762, 763, 765, 768, 769, 770, 791, 848, 850, 858, 860, 861, 862, 863, 866, 868, 870, 871, 872, 873, 875, 876, 879, 880, 881, 882, 884, 916, 923, 934
Opportunities for solitude, 189, 703, 704, 706, 707, 708, 709, 710, 712
Ore, 2, 3, 6, 7, 9, 35, 36, 44, 45, 46, 47, 48, 49, 53, 54, 55, 56, 65, 77, 94, 99, 100, 101, 108, 132, 143, 193, 194, 200, 201, 207, 208, 209, 211, 212, 220, 227, 233, 234, 237, 283, 344, 345, 350, 365, 367, 369, 370, 371, 373, 375, 376, 378, 379, 380, 381, 382, 383, 384, 386, 387, 388, 389, 393, 394, 396, 397, 398, 400, 411, 415, 425, 426, 428, 434, 442, 445, 466, 479, 482, 496, 572, 591, 595, 637
Other wildlife species of interest, 29, 713, 792, 910, 911, 914
Outfall, 5, 60, 61, 100, 482
Particulate matter, 19, 24, 83, 224, 226, 227, 229, 230, 231, 232, 233, 234, 235, 238, 239
Peak flow, 254, 295, 297, 298, 299, 331, 333, 334, 335, 451, 454, 463, 470, 474, 476, 477, 478, 486, 608
Periphyton, 79, 249, 251, 268, 269
Phosphorus, 76, 255, 310, 493, 495, 496, 499, 604, 618, 619
Pileated woodpecker, 28, 146, 665, 671, 674, 675, 714, 719, 720, 721, 722, 724, 726, 778, 779, 780, 781, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 828, 832, 910, 911, 914
Plan of operations, 1, 5, 6, 8, 9, 11, 12, 13, 23, 38, 44, 56, 61, 92, 93, 109, 150, 221, 222, 339, 340, 342, 343, 351, 409, 507
Plum Creek Timber Company, 22, 25, 97, 162, 166, 172, 176, 177, 182, 184, 185, 196, 206, 217, 219, 222, 223, 392, 393, 456, 523, 525, 526, 536, 538, 541, 542, 543, 548, 567, 575, 577, 615, 745, 746, 747, 768, 769, 770, 881, 890, 901, 905
Pool frequency, 130, 247
Pool quality, 260, 296
Poorman Creek, 34, 41, 44, 57, 62, 67, 68, 69, 86, 91, 110, 114, 115, 116, 117, 118, 120, 140, 141, 155, 189, 195, 199, 229, 245, 248, 251, 252, 254, 257, 260, 262, 264, 267, 272, 275, 276, 277, 281, 284, 287, 291, 292, 294, 301, 303, 316, 319, 320, 321, 325, 372, 426, 443, 449, 451, 452, 453, 455, 456, 457, 458, 460, 464, 465, 467, 469, 471, 472, 473, 479, 486, 490, 498, 500, 519, 546, 548, 549, 550, 551, 552, 553, 554, 557, 608, 650, 651, 674, 693, 699, 701, 709, 810, 860, 889, 893, 917
Prevention of significant deterioration, 224, 225, 227, 230, 233, 235, 239
Previously harvested coniferous forest, 656, 657, 658, 659, 660, 661, 662, 663, 687, 868, 871, 910, 913, 926, 927, 928, 929, 930, 931, 932, 934
Private land, 11, 12, 18, 42, 89, 94, 97, 165, 170, 174, 175, 181, 186, 196, 206, 216, 223, 292, 303, 324, 332, 334, 343, 428, 524, 525, 526, 532, 537, 548, 554, 555, 561, 577, 589, 613, 615, 630, 667, 668, 671, 677, 678, 691, 706, 716, 724, 731, 735, 737, 744, 747, 751, 758, 760, 767, 770, 790, 804, 806, 816, 818, 825, 830,

831, 838, 845, 850, 866, 868, 869, 871, 878, 879, 880, 884, 898, 900, 901, 905, 907, 924, 933
Public participation, 29
Radio and TV effects, 237, 551, 553, 707, 709
Ramsey Creek, 6, 7, 32, 33, 34, 35, 38, 39, 41, 44, 45, 46, 47, 48, 49, 53, 55, 56, 59, 60, 61, 62, 63, 64, 66, 67, 68, 69, 71, 72, 75, 76, 79, 85, 86, 87, 90, 91, 92, 99, 110, 116, 117, 118, 119, 127, 128, 131, 141, 149, 155, 156, 158, 159, 160, 161, 167, 168, 186, 188, 189, 190, 192, 193, 196, 198, 199, 205, 207, 208, 209, 225, 228, 229, 234, 236, 245, 248, 249, 250, 251, 252, 254, 255, 257, 259, 260, 262, 263, 264, 267, 268, 272, 274, 275, 276, 278, 281, 283, 284, 285, 287, 288, 290, 291, 294, 296, 297, 301, 302, 303, 309, 310, 313, 316, 318, 319, 321, 323, 327, 328, 331, 332, 336, 338, 343, 344, 348, 349, 352, 353, 357, 365, 371, 372, 383, 387, 388, 389, 390, 391, 395, 423, 424, 428, 431, 442, 447, 449, 451, 452, 453, 456, 457, 458, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 474, 476, 480, 485, 486, 487, 490, 498, 500, 501, 503, 508, 509, 510, 513, 515, 519, 520, 524, 532, 535, 536, 537, 541, 542, 543, 546, 549, 551, 552, 553, 554, 557, 563, 565, 577, 597, 598, 599, 600, 602, 608, 609, 613, 614, 617, 622, 623, 631, 634, 636, 637, 638, 643, 650, 651, 652, 653, 674, 676, 693, 699, 700, 701, 706, 707, 708, 709, 710, 711, 755, 758, 766, 768, 772, 773, 775, 776, 777, 780, 783, 784, 785, 810, 840, 841, 844, 849, 860, 867, 869, 874, 876, 877, 878, 888, 889, 890, 893, 894, 896, 903, 917
Record of Decision, 4, 13, 15, 17, 18, 19, 23, 29, 30, 55, 88, 148, 186, 188, 217, 219, 221, 524, 534, 540, 551, 702, 885
Recreation opportunity spectrum, 545, 546, 551, 553, 554, 555, 556, 557
Redband trout, 159, 200, 219, 246, 254, 257, 267, 272, 274, 275, 276, 280, 282, 288, 290, 291, 292, 300, 301, 306, 307, 313, 317, 323, 325, 326, 327, 329, 331, 333, 334, 335, 337, 349
Residuum/glacial soils, 598, 599
Revegetation, 46, 66, 76, 77, 78, 81, 82, 84, 97, 98, 121, 156, 176, 180, 182, 185, 217, 240, 297, 305, 319, 341, 344, 346, 529, 557, 562, 563, 565, 566, 597, 601, 604, 606, 618, 621, 624, 625, 626, 627, 628, 629, 630, 660, 663, 664, 699, 734, 757, 863, 895, 920
Riparian areas, 27, 85, 115, 116, 125, 126, 127, 130, 152, 164, 174, 175, 178, 181, 184, 188, 195, 199, 247, 248, 250, 253, 260, 263, 264, 287, 292, 296, 297, 298, 299, 300, 302, 303, 314, 318, 322, 324, 326, 329, 330, 332, 334, 335, 338, 340, 341, 342, 343, 344, 346, 347, 348, 527, 529, 530, 596, 656, 657, 658, 659, 660, 661, 662, 663, 671, 680, 686, 695, 714, 717, 720, 721, 724, 730, 747, 749, 751, 752, 753, 756, 764, 768, 780, 783, 784, 785, 786, 787, 789, 807, 808, 809, 810, 812, 813, 814, 817, 832, 834, 835, 837, 839, 846, 848, 859, 863, 868, 871, 873, 877, 879, 883, 889, 890, 894, 898, 909, 910, 911, 912, 913, 917, 926, 927, 928, 929, 931, 932, 934
Riparian habitat conservation area, 27, 31, 91, 92, 114, 116, 129, 149, 150, 162, 173, 174, 175, 180, 181, 184, 188, 190, 194, 199, 200, 247, 248, 249, 253, 295, 296, 299, 303, 314, 318, 319, 322, 324, 329, 330, 332, 334, 335, 337, 338, 339, 340, 343, 344, 347, 348, 531, 643, 656, 662, 664, 695
Rock Creek Project, 3, 29, 102, 104, 187, 207, 209, 211, 212, 213, 219, 220, 221, 238, 239, 243, 249, 250, 252, 269, 282, 336, 372, 375, 376, 385, 393, 397, 446, 447, 478, 487, 521, 543, 550, 556, 592, 593, 594, 689, 710, 711, 727, 746, 748, 754, 757, 763, 768, 769, 777, 839, 845, 848, 855, 857, 881, 883, 916
Rock Lake, 3, 6, 7, 11, 27, 32, 33, 40, 42, 44, 45, 47, 53, 54, 71, 78, 96, 99, 108, 125, 142, 151, 192, 230, 249, 252, 255, 267, 268, 273, 278, 279, 281, 288, 289, 290, 294, 301, 307, 309, 311, 312, 314, 315, 320, 321, 322, 336, 368, 369, 370, 372, 396, 397, 398, 419, 422, 424, 425, 426, 428, 431, 432, 433, 434, 435, 442,

446, 447, 448, 452, 454, 455, 460, 461, 462, 467, 470, 472, 478, 479, 496, 497, 500, 545, 548, 551, 562, 565, 566, 599, 623, 636, 637, 707, 775
Sanders County, 3, 219, 572, 578, 580, 592, 593, 594, 705
Scenic driving, 548, 552
School districts, 572, 579, 580, 591, 592
Schools, 90, 133, 525, 545, 548, 572, 575, 578, 579, 580, 581, 582, 583, 590, 591, 592, 595
Scoping, 26, 29, 91, 93, 206, 214, 242, 243, 726
Section 404 permit, 4, 5, 14, 15, 16, 19, 23, 24, 30, 127, 128, 158, 187, 690, 701, 702
Security habitat, 137, 143, 200, 201, 729, 730, 733, 734, 735, 736, 737, 738, 739, 742, 743, 744, 745, 746, 747, 848, 854, 855, 916, 917, 921, 922, 923
Sediment, 27, 41, 50, 62, 63, 64, 65, 66, 71, 74, 75, 77, 78, 79, 84, 88, 113, 115, 119, 130, 131, 152, 156, 159, 168, 173, 180, 183, 218, 247, 253, 254, 260, 263, 265, 269, 270, 293, 295, 297, 298, 299, 301, 302, 303, 304, 305, 306, 308, 312, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 326, 327, 328, 329, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 342, 348, 350, 367, 368, 371, 379, 380, 387, 390, 391, 413, 418, 423, 453, 457, 465, 466, 483, 497, 501, 502, 506, 507, 509, 510, 512, 513, 514, 515, 516, 517, 518, 597, 598, 599, 600, 601, 602, 603, 606, 608, 609, 610, 611, 612, 613, 614, 615, 616, 630, 680, 694, 695, 696, 697, 702, 835, 836, 837, 838
Sedlak Park, 6, 15, 45, 53, 159, 160, 166, 168, 173, 174, 178, 180, 181, 182, 183, 184, 185, 206, 213, 225, 331, 365, 456, 515, 516, 525, 536, 541, 542, 544, 567, 568, 569, 639, 643, 644, 645, 652, 654, 661, 682, 683, 687, 688, 689, 691, 698, 737, 738, 739, 743, 766, □794, 797, 798, 864, 868, 871
Sensitive species, 13, 29, 147, 200, 246, 253, 257, 301, 316, 323, 324, 327, 333, 334, 335, 665, 681, 682, 706, 713, 726, 792, 794, 798, 806, 808, 816, 826, 831, 839, 845, 846, 909, 910, 911, 914, 924, 925, 928, 929, 932
Silver, 1, 3, 7, 9, 10, 11, 55, 61, 187, 191, 192, 213, 219, 222, 226, 268, 283, 293, 368, 369, 370, 372, 375, 376, 378, 379, 381, 382, 387, 393, 397, 414, 427, 437, 441, 455, 481, 482, 483, 484, 489, 491, 493, 495, 496, 499, 502, 506, 517, 574, 591, 592, 795, 849
Snags and woody debris, 714
Socioeconomic, 572
Soil loss, 168, 601, 602, 603, 606, 608, 609, 610, 611, 612, 613, 615, 616, 630, 631
Soils salvage, 46, 73, 76, 95, 98, 153, 601, 603, 604, 605, 609, 611, 612, 617, 618, 619, 620, 621, 622, 623, 625, 626, 628, 629, 630, 631, 632
Solid waste management, 17
Sound, 8, 11, 12, 15, 29, 37, 109, 237, 526, 547, 551, 553, 571, 594, 633, 635, 636, 637, 638, 639, 642, 703, 704, 707, 708, 709
Species of concern, 42, 87, 88, 159, 164, 246, 254, 272, 681, 682, 683, 684, 713, 792, 924, 925, 927, 929, 930, 931, 932, 933, 934
Spring, 27, 40, 87, 109, 121, 123, 124, 126, 127, 137, 139, 147, 157, 229, 230, 263, 268, 269, 295, 297, 298, 302, 307, 350, 398, 419, 422, 424, 425, 426, 428, 432, 433, 434, 436, 440, 443, 444, 445, 446, 449, 450, 451, 454, 455, 457, 460, 461, 462, 478, 479, 484, 486, 496, 497, 499, 520, 549, 648, 649, 685, 688, 690, 692, 693, 694, 696, 697, 729, 750, 772, 794, 839, 857, 858, 860, 862, 867, 870, 878, 883, 917
St. Paul Lake, 44, 53, 125, 230, 249, 255, 268, 281, 307, 314, 315, 320, 322, 336, 397, 419, 424, 432, 433, 447, 452, 454, 455, 462, 467, 470, 501
State Historic Preservation Office, 19, 23, 85, 149, 351, 352, 354, 357, 359, 362, 363, 364
State species of concern, 147, 665, 915, 924, 925, 927, 929, 930, 931, 932, 933, 934
Stream crossing, 19, 110, 168, 175, 199, 200, 201, 205, 212, 299, 303, 313, 314, 326, 328, 332, 339, 340, 342, 347, 458,

463, 470, 474, 476, 477, 486, 507, 514, 515, 698, 699
Streamflow, 2, 27, 35, 78, 86, 109, 113, 125, 128, 158, 172, 253, 254, 267, 288, 295, 298, 302, 303, 306, 307, 308, 315, 316, 321, 322, 323, 324, 327, 331, 333, 334, 335, 336, 342, 349, 350, 416, 417, 422, 423, 430, 431, 432, 433, 442, 449, 450, 451, 453, 456, 461, 463, 464, 470, 472, 474, 476, 477, 478, 479, 486, 500, 508, 519, 521, 835, 839
Subsidence, 29, 35, 108, 201, 205, 211, 394, 395, 396, 397, 398, 399, 400, 412
Sulfur dioxide, 224, 225, 226, 229, 230, 231, 232, 233, 235, 238, 239
Tailings management, 7, 19, 22, 27, 30, 31, 32, 33, 34, 35, 36, 38, 39, 44, 45, 46, 47, 48, 49, 50, 51, 52, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 72, 73, 74, 75, 76, 77, 78, 80, 81, 82, 83, 85, 86, 87, 91, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 123, 127, 128, 149, 150, 151, 153, 154, 155, 156, 157, 158, 160, 186, 187, 188, 190, 192, 194, 195, 196, 199, 200, 201, 202, 203, 204, 205, 207, 208, 209, 210, 211, 212, 215, 217, 220, 224, 225, 227, 229, 233, 236, 237, 238, 254, 276, 282, 301, 302, 303, 304, 305, 306, 307, 308, 312, 313, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 340, 344, 345, 349, 352, 354, 355, 357, 365, 368, 371, 372, 373, 376, 380, 381, 382, 383, 387, 388, 389, 390, 391, 393, 394, 395, 401, 402, 403, 404, 405, 406, 407, 408, 409, 411, 414, 415, 417, 418, 423, 424, 426, 428, 435, 436, 437, 439, 442, 443, 444, 445, 446, 448, 450, 452, 453, 454, 458, 459, 460, 464, 466, 467, 468, 469, 471, 472, 473, 475, 476, 479, 482, 486, 487, 490, 497, 500, 501, 503, 505, 507, 508, 509, 510, 512, 513, 517, 521, 524, 531, 532, 534, 535, 536, 543, 550, 551, 552, 553, 554, 557, 558, 560, 562, 564, 565, 566, 570, 586, 596, 598, 599, 600, 602, 603, 605, 606, 607, 608, 609, 610, 611, 612, 617, 618, 619, 620, 621, 622, 623, 624, 625, 627, 631, 634, 636, 637, 643, 650, 651, 658, 660, 664, 682, 683, 691, 692, 693, 695, 696, 697, 700, 701, 707, 708, 709, 710, 718, 719, 720, 722, 723, 754, 755, 756, 780, 783, 784, 785, 789, 801, 803, 804, 812, 833, 894, 908, 911, 918, 919, 925, 927
Tax revenue, 572, 590, 591, 595
Taxa richness, 268, 269, 270
Taxable valuation, 579, 580
Temperature, 76, 130, 228, 229, 249, 250, 254, 255, 270, 292, 293, 304, 310, 314, 315, 326, 374, 427, 456, 481, 484, 485, 487, 492, 494, 498, 502, 667, 671, 729, 750, 835
Threatened and endangered fish species, 245
Threatened and endangered species, 13, 14, 23, 132, 173, 180, 183, 210, 245, 326, 327, 337, 526, 681, 682, 713, 846, 847, 854, 855, 856, 884, 907
Total dissolved solids, 4, 157, 190, 256, 268, 382, 413, 414, 415, 426, 427, 436, 437, 440, 441, 442, 444, 445, 446, 480, 481, 484, 485, 488, 489, 491, 492, 494, 496, 497, 498, 500, 501, 502, 504, 506, 508, 511
Total maximum daily loads, 19, 482, 483
Total suspended particulates, 226, 229
Toxic metals in fish, 325
Traditional cultural property, 351, 706
Traffic, 28, 33, 37, 67, 68, 69, 115, 116, 117, 118, 119, 132, 140, 142, 154, 155, 156, 167, 171, 175, 177, 182, 185, 205, 217, 338, 339, 341, 551, 553, 555, 556, 562, 570, 615, 633, 636, 637, 638, 642, 644, 645, 646, 648, 649, 650, 651, 652, 653, 654, 655, 681, 707, 740, 759, 763, 808, 812, 813, 814, 816, 817, 838, 839, 850, 851, 852, 853, 854, 856, 869, 878, 887, 889, 890, 893, 894, 896, 897, 903, 904, 905, 907
Trails, 42, 87, 118, 140, 142, 143, 149, 165, 189, 213, 216, 218, 222, 243, 299, 322, 324, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 392, 517, 545, 546, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 638, 639, 670, 680, 705, 808, 840, 858, 859, 886, 887, 889, 893, 897, 899, 904
Transient analysis, 430

Transportation, 9, 22, 132, 191, 202, 220, 519, 575, 583, 602, 643, 644, 653, 654, 756, 766, 854, 856, 924
Tribal treaty rights, 13, 241, 242, 243, 292
Troy Mine, 36, 56, 101, 108, 345, 368, 370, 372, 375, 376, 378, 379, 380, 381, 386, 387, 388, 397, 398, 403, 487, 489, 594, 634, 637, 777, 845
Vegetation clearing, 96, 123, 124, 146, 147, 161, 162, 169, 173, 175, 180, 183, 254, 301, 314, 331, 332, 334, 347, 358, 363, 513, 514, 625, 628, 659, 661, 663, 688, 689, 737, 760, 761, 762, 773, 774, 841, 843, 846, 852, 869, 910, 912
Visibility, 28, 65, 76, 110, 173, 179, 180, 183, 206, 224, 225, 226, 227, 230, 231, 235, 236, 352, 354, 362, 530, 531, 551, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 649, 707, 708, 710, 711, 712
Visual Quality Objective, 27, 531, 558, 559, 561, 562, 563, 565, 566, 567, 568, 569, 624
Waste management, 66, 101
Waste rock, 6, 27, 35, 36, 44, 45, 47, 48, 49, 51, 53, 57, 58, 60, 61, 62, 69, 71, 72, 73, 79, 80, 92, 94, 95, 98, 99, 100, 101, 104, 105, 106, 107, 114, 118, 119, 149, 151, 201, 208, 233, 344, 345, 346, 365, 371, 373, 374, 375, 376, 379, 383, 384, 385, 386, 387, 388, 389, 390, 391, 401, 460, 464, 465, 469, 500, 501, 508, 509, 605, 608, 619, 623, 625, 627, 636
Wastewater, 19, 60, 62, 63, 92, 94, 107, 113, 114, 115, 220, 256, 308, 311, 418, 440, 444, 460, 464, 465, 468, 471, 482, 485, 487, 488, 489, 490, 491, 501, 503, 508, 509, 510, 512, 521, 579
Water treatment, 17, 32, 60, 61, 63, 72, 92, 93, 94, 100, 114, 215, 220, 438, 444, 469, 487, 503, 505, 510, 513, 586, 637
Water use, 20, 21, 25, 57, 58, 60, 107, 112, 428, 450, 519, 521
Weed control, 46, 67, 75, 84, 122, 123, 128, 180, 182, 185, 217, 347, 684, 685, 687, 688, 689
West Fisher Creek, 161, 178, 183, 184, 189, 205, 206, 207, 213, 219, 221, 245, 247, 249, 252, 267, 270, 271, 280, 281, 284, 287, 288, 292, 294, 295, 298, 299, 300, 316, 330, 334, 335, 393, 449, 450, 452, 455, 456, 457, 477, 485, 514, 517, 524, 525, 536, 538, 542, 543, 545, 548, 549, 559, 577, 616, 621, 630, 638, 639, 640, 641, 642, 654, 663, 671, 678, 682, 683, 685, 691, 693, 698, 730, 739, 772, 777, 780, 787, 796, 798, 810, 816, 849, 862, 873, 888, 890, 901, 905, 907, 917
Western toad, 164, 178, 793, 832, 833, 835, 836, 837, 838, 839
Westslope cutthroat trout, 273, 276, 278, 279, 288, 289, 300
Wetland mitigation, 50, 72, 85, 86, 87, 106, 127, 128, 157, 158, 178, 695, 697, 699, 700, 701, 720, 722, 724, 755, 756, 766, 768, 783, 784, 786, 787, 789, 809, 813, 814, 833, 835, 836, 838, 839, 846, 871, 890, 894, 896, 898, 903
Wetlands, 14, 23, 29, 30, 31, 43, 46, 50, 51, 52, 72, 85, 86, 87, 91, 92, 95, 101, 106, 107, 121, 124, 125, 126, 127, 128, 150, 157, 158, 164, 173, 174, 178, 179, 181, 182, 183, 185, 188, 191, 194, 195, 196, 210, 247, 252, 253, 298, 399, 436, 507, 515, 531, 608, 609, 626, 643, 656, 657, 658, 659, 660, 661, 662, 663, 686, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 714, 720, 722, 724, 730, 732, 735, 737, 738, 739, 741, 743, 747, 751, 752, 753, 755, 756, 758, 760, 761, 764, 766, 768, 783, 784, 786, 787, 789, 794, 796, 807, 808, 809, 813, 814, 832, 833, 834, 835, 836, 837, 838, 839, 846, 868, 871, 873, 879, 890, 894, 896, 898, 903, 910, 911, 912, 913, 926, 927, 928, 929, 931, 932, 934
White-tailed deer, 29, 726, 731, 748, 749, 750, 751, 752, 753, 764, 767, 770
Width/depth ratio, 130, 247, 251
Wilderness attributes, 704, 707, 708, 711
Wildlife linkage zone, 731, 735, 737, 738, 739, 744, 751, 759, 760, 762, 767, 863, 868, 871, 872, 874, 879, 917, 920, 923
Wind erosion, 83, 603
Winter activities, 549
Winter range, 163, 166, 178, 200, 201, 528, 529, 533, 537, 538, 540, 541, 542, 543, 727, 728, 729, 730, 731, 732, 734, 735,

737, 738, 739, 741, 744, 745, 746, 747, 748, 749, 751, 752, 753, 757, 758, 760, 762, 764, 767, 770, 771, 772, 849, 915, 916, 917, 918, 919, 920, 921, 923, 924, 934

Wolverine, 793, 839, 840, 841, 844, 845, 846

Zinc, 4, 83, 190, 256, 282, 283, 294, 312, 323, 326, 373, 374, 379, 381, 382, 384, 385, 386, 387, 413, 414, 427, 437, 441, 480, 481, 482, 484, 485, 493, 495, 496, 499, 502, 503, 504, 506, 511, 574

Chapter 6. List of Acronyms

Acronym	Acronym Description
ABA	Acid-Base Accounting
ABP	Acid-Base Potential
ADT	Average Daily Traffic
AERMIC	American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee
AERMOD	Air Dispersion Model
AIRFA	American Indian Religious Freedom Act
ALS	Aquatic Life Standard
ANC	Acid-Neutralizing Capability
APE	Area of Potential Effect
APLIC	Avian Power Line Interaction Committee
AQRV	Air Quality Related Values
ARD	Acid Rock Drainage
ARMB	Montana Air Resources Management Bureau
ASARCO	American Smelting and Refining Company
BA	Biological Assessment
BAA	Bear Activity Area
BACT	best available control technology
BCI	Biotic Community Index
BE	Biological Evaluation
BHES	Board of Health and Environmental Sciences
BLM	Bureau of Land Management
BLM	Biotic Ligand Model
BMP	best management practice
BMU	Bear Management Unit
BO	Biological Opinion
Borax	U.S. Borax and Chemical Corporation
BORZ	(Grizzly) Bear Outside the Recovery Zone
BPA	Bonneville Power Administration
BPT	best practicable control technology
CEM	Cumulative effects model
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CMW	Cabinet Mountains Wilderness
CO	carbon monoxide
Corps	U.S. Army Corps of Engineers
DAT	Deposition Analysis Threshold
dB	decibel
dBμV/m	decibel-microvolts per meter
dbh	diameter at breast height
Draft EIS	Draft Environmental Impact Statement
DEQ	Montana Department of Environmental Quality
DHES	Montana Department of Health and Environmental Sciences (now DEQ)

Acronym	Acronym Description
DNRC	Montana Department of Natural Resources and Conservation
DOC	Montana Department of Commerce
DSL	Montana Department of State Lands (now DEQ)
EA	Environmental Assessment
Eagle Act	Bald and Golden Eagle Protection Act
ECA	Equivalent Clearcut Acres
ECAC	Equivalent Clearcut Acres Calculator
EIS	Environmental Impact Statement
ELGs	Effluent Limitations Guidelines
EMF	Electric Field and Magnetic Field
EMU	Elk Management Unit
EPA	Environmental Protection Agency
EPT	Ephemeroptera, Plecoptera, and Trichoptera
ER	Enrichment Ratio
ESA	Endangered Species Act
FCC	Federal Communications Commission
Final EIS	Final EIS
FLAG	Federal Land Managers' Air Quality Related Values Workgroup
FMEA	Failure Modes and Effects Analysis
FOS	Factors of Safety
FSH	Forest Service Handbook
FSM	Forest Service Manual
FWP	Montana Fish, Wildlife, and Parks
FY	Fiscal Year
GDE	Ground Water Dependent Ecosystem
GIS	Geographic Information System
gpm	gallons per minute
GPS	Global Positioning System
H&H	Hydraulic and Hydrologic
HABS	Historic American Building Survey
HAER	Historic American Engineering Record
HAP	Hazardous Air Pollutant
HD	Hunting District
HDPE	high density polyethylene
HE	Habitat Effectiveness
HGM	Hydrogeomorphic
HR	Hayes Ridge
HRMIB	Hard Rock Mining Impact Board
HRV	Historical Range of Variation
HU	Habitat Unit
Hz	hertz
IGBC	Interagency Grizzly Bear Committee
Impact Plan	Hard-Rock Mining Impact Plan
INFS	Inland Native Fish Strategy
IRA	Inventoried Roadless Area
IRIS	Integrated Risk Information System
ISC	Industrial Source Complex
KFP	Kootenai Forest Plan

Acronym	Acronym Description
KNF	Kootenai National Forest
KOP	Key Observation Point
kV	kilovolt
kV/m	1,000 volts per meter
kw	kilowatt
kwh	kilowatt-hour
LAC	Level of Acceptable Change
LAU	Lynx Analysis Units
LCAS	Lynx Conservation Assessment and Strategy
LOC	Levels of Concern
LOS	Level of Service
LWD	Large woody debris
M bcy	million bank cubic yards
MA	Management Area
MAAQS	Montana Ambient Air Quality Standards
MAC Report	Mineral Activity Coordination Report
MAGIC	Model of Acidification of Groundwater in Catchments
MAQP	Montana Air Quality Permit
MBEMP	Montana Bald Eagle Management Plan
MBEWG	Montana Bald Eagle Working Group
MBTA	Migratory Bird Treaty Act
MCA	Montana Code Annotated
MCE	Maximum Credible Earthquake
MDT	Montana Department of Transportation
MEPA	Montana Environmental Policy Act
MFISH	Montana Fisheries Information System
MFSA	Montana Major Facility Siting Act
mG	milligauss
MIS	Management Indicator Species
mmbf	million board feet
MMC	Montanore Minerals Corporation
MMI	Mines Management, Inc.
MMRA	Metal Mine Reclamation Act
MNHP	Montana Natural Heritage Program
MOU	Memorandum of Understanding
MP	milepost
MPDES	Montana Pollutant Discharge Elimination System
mph	miles per hour
MW	Megawatt (1,000,000 watts or 1,000 kilowatts)
MWh	Megawatt hour (1,000 kilowatt-hours)
N	nitrogen
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Grave Protection and Repatriation Act
NCDE	Northern Continental Divide Ecosystem
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFS	National Forest System
NHPA	National Historic Preservation Act

Acronym	Acronym Description
NO_2	nitrogen dioxide
NOI	Notice of Intent
Noranda	Noranda Minerals Corporation
NRHP	National Register of Historic Places
OG	effective old growth
OHV	Off Highway Vehicle
OLM	Ozone Limiting Method
OMRD	Open Motorized Route Density
ORD	Open Road Density
pcf	pounds per cubic foot
Plum Creek	Plum Creek Timber Company
PM_{10} and $PM_{2.5}$	particulate matter less than 10 and 2.5 microns
PMOA	1997 Programmatic Memorandum of Agreement
PPI	Potential Population Index
PPL	Potential Population Level
PSD	Prevention of Significant Deterioration
PSU	Planning Sub-Unit
RHCA	Riparian Habitat Conservation Area
RMO	Riparian Management Objective
ROD	Record of Decision
ROG	Replacement Old Growth
ROS	Recreation Opportunity Spectrum
SADT	Seasonal Average Daily Traffic
SAG	semi-autogenous grinding
SC	specific conductance
SHPO	State Historic Preservation Office
SOx	Sulfur oxides
SPLP	Synthetic Precipitation Leaching Procedure
SPT	Standard Penetration Test
SWPPP	Storm Water Pollution Prevention Plan
T&E	Threatened and Endangered
TBEL	Technology-Based Effluent Limit
TCP	Traditional Cultural Property
TDS	total dissolved solid
TMDL	Total Maximum Daily Load
TMRD	Total Motorized Route Density
tpd	tons per day
tpy	tons per year
TRB	Transportation Research Board
TSMRS	Timber Stand Management Record System
TSP	total suspended particulate
TSS	total suspended solid
TWSC	Two-Way, Stop Controlled
USDA	U.S. Department of Agriculture
USFWS	USDI Fish and Wildlife Service
USGS	U.S. Geological Survey
V/m	volt per meter
VMS	Visual Management System

Acronym	Acronym Description
VQO	Visual Quality Objective
VRU	Vegetation Response Units
WQBEL	Water Quality-Based Effluent Limit

Chapter 7. Glossary

acid-base potential	A laboratory method to determine the acid-generating potential of sulfide minerals.
adit	A nearly horizontal passage, driven from the surface, by which a mine may be entered, ventilated, and dewatered.
alluvium	Soil and rock that is deposited by flowing water.
alteration haloes	Zones of changed mineralogy that occur around the ore deposit, containing chalcopyrite-calcite, pyrite-calcite, and galena-calcite mineralization.
ambient	Surrounding, existing.
anadromous	Fish that spend all or part of their adult life in salt water and return to freshwater streams and rivers to spawn.
aquifer	Rock or sediment which is saturated with water and sufficiently permeable to transmit quantities of water.
argillite	A rock that has formed as a result of the hardening of sediments by pressure and heat. Argillite is harder than mudstone and not as hard as shale. The rock is composed largely of particles of clay size and its made up of thin laminates.
authigenic	Pertaining to minerals or materials that grow in place with a rock, rather than having been transported and deposited.
base flow	Base flow is the flow of a perennially flowing stream without any direct surface runoff; such flow is the result of ground water seepage into the stream channel.
bear analysis area (BAA)	A sub-unit of a BMU used to analyze open road densities. Also used to determine the adequate amount of replacement habitat.
bear management unit (BMU)	Land area containing sufficient quantity and quality of all seasonal habitat components to support a female grizzly. Used to analyze percent habitat effectiveness (HE).
Best Management Practices	Structural, non-structural, and managerial techniques that are recognized to be the most effective and practical means to control non-point source pollutants.
bioavailable	The state of a toxicant such that there is increased physicochemical access to the toxicant by an organism. The less the bioavailability of a toxicant, the less its toxic effect on an organism.
bioconcentration	Chemicals that increase in living organisms resulting in concentrations greater than those found in the environment.
biodiversity	A term that describes the variety of lifeforms, the ecological role they perform, and the genetic diversity they contain.
blasting	To remove, open, or form by or as if by an explosive.
borrow materials	Soil or rock dug from one location to provide fill at another location.
broadcast seeding	A means of planting where seed is distributed on the ground surface mechanically or by hand.

Candidate species	Those species under consideration for possible listing as "endangered," or "threatened," in accordance with the 1973 Endangered Species Act.
carbonate	A sedimentary rock composed chiefly of carbonate minerals (*e.g.*, limestone and dolomite).
carrying capacity	The maximum number of animals that can be sustained over the long term on a specified land area.
catchment	A geographic area that collects rain or snowfall.
clastic	Consisting of fragments of rocks that have been removed individually from their places of origin.
colluvial	Rock detritus and soil accumulated at the foot of a slope.
colluvium	Fragments of rock carried and deposited by gravity.
complexation	The formation of complex chemical species.
concentrate	To make less dilute.
confluence	The point where two streams meet.
core grizzly bear habitat	An area of high quality habitat within a Bear Management Unit that is greater than or equal to 0.31 miles from any road (open or restricted), or motorized trail. Core habitat may contain restricted roads, but such roads must be effectively closed with devices, including but not limited to, earthen berms, barriers, or vegetative growth.
corridor	A defined tract of land, usually linear, through which a species must travel to reach habitat suitable for reproduction and other life-sustaining needs.
Cretaceous	The third and latest of the periods included in the Mesozoic Era. Also, the system of strata deposited in the Cretaceous period and related most commonly to the age of the dinosaurs.
Cumulative Effects Model	Vegetation mapping for the KNF based on 1992 satellite imagery and updated for harvest activities through 1995.
cutoff	A clay-filled trench beneath a dam to "cut off" water seeping beneath the dam.
cyclone	Centrifugal classifying device.
dBA or decibels A scale	A logarithmic unit for measuring sound intensity, using the decibel A weighted scale, which approximates the sound levels heard by the human ear at moderate sound levels, with a 10 decibel increase being a doubling in sound loudness.
deep rip	Breaking up compacted soil or overburden, to a depth below normal tillage.
degradation	A process by which the quality of water in the natural environment is lowered.
dendritic	The branching of natural drainage systems.
dike	A tabular body of igneous rock that cuts across the structure of adjacent rock units.
dilatant	Increasing in viscosity and setting to a solid as a result of deformation by expansion, pressure, or agitation.
dilution	A process in which the chemical concentration of constituents in a stream decreases as a result of mixing with cleaner water.

dispersal	The movement, usually one way, and on any time scale, of plants or animals from their point of origin to another location where they subsequently produce offspring.
dispersed recreation	Recreation that occurs outside of developed sites in the unroaded and roaded environment (*e.g.*, hunting, backpacking, and berry picking).
downgradient	A direction characterized by lower fluid potential or hydraulic head.
drift	A nearly horizontal mine passageway driven on or parallel to the course of a vein or rock stratum.
drill seeding	A mechanical method for planting seed in soil.
drilling	To bore or drive a hole in.
effective old growth	Old growth that not only meets all the age and size class requirements along with typical habitat components such as snags and dead and down logs, but also is large enough or with appropriate shape to allow species dependent on forest interiors to flourish. This is a subjective term with many variables, particularly with regards to the wildlife or plant species affected. Also see "old growth areas managed by the KNF Forest Plan."
effluent	Waste water discharge.
embeddedness	The degree to which rocks are covered up by the substrate material (sand, clay, silt, etc.).
endangered	Any species, plant or animal that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of the Interior in accordance with the 1973 Endangered Species Act.
Endangered Species Act	An act of Congress, enacted in 1973, to protect and recover threatened or endangered plant or animal species and their habitats. The Secretary of the Interior, in accordance with the Act, identifies or lists the species as "threatened" or "endangered."
ephemeral stream	A stream that flows only as a direct response to rainfall or snowmelt events; having no base flow.
evaporation	The physical separation of a liquid from a dissolved or suspended solid. Energy is applied to the system to volatize the liquid leaving the solids behind.
evapotranspiration	The water lost from an area through the combined effects of evaporation from the ground surface and transpiration from the vegetation.
face	The part of an adit or mine that is actively being excavated; the end of the adit being excavated.
facies	A distinctive group of characteristics within part of a rock body (such as composition, grain size, or fossil assemblages) that differ as a group from those found elsewhere in the same rock unit.
factor-of-safety	Forces causing sliding divided by forces resisting sliding; for example, at a factor-of-safety of 1.0, the forces causing sliding are the same as those resisting sliding.
fault	A fracture or fracture zone where there has been displacement of the sides relative to one another.

flotation	A mineral recovery process where individual mineral grains are selectively "floated" and skimmed off the top of an agitated water/chemical bath.
forb	Any herbaceous plant, usually broadleaved, that is not a grass or grass-like plant.
fragmentation	Process of reducing size and connectivity of stands that comprise a forest. In more general terms, fragmentation can refer to the state of two or more similar habitat locations separated by a land use or type that is incompatible with the species in question's ability to traverse it.
freeboard	The height above the recorded high-water mark of a structure (as a dam) associated with the water.
genus	A group of related species used in the classification of organisms (plural = genera).
glacial moraine	Mounds and ridges of broken rock and soil particles deposited by glacial action.
glaciofluvial	Pertaining to the meltwater streams flowing from wasting glacier ice and especially to the deposits and landforms produced by such streams.
glaciolacustrine	Refers to sediments or processes involving a lake that received meltwater from glacial ice.
granodiorite	A rock roughly equivalent to granite, which is formed deep within the earth at high temperatures and pressures.
habitat effectiveness	The ability of the habitat to be used to its fullest extent for the biological needs of a given species. Habitat effectiveness can be reduced by several factors, such as disturbance or proximity of inappropriate habitat, which may reduce the use of some of the area even though all the necessary habitat components are present.
habituate	Become accustomed to.
hardness	A measure of the amount of calcium, magnesium, and iron dissolved in the water.
Hard Rock Mining Impact Plan	An impact plan that identifies the local government services and facilities that will be needed as a result of the mineral development. The developer of each proposed new large-scale hard rock mine in Montana is required to prepare an impact plan.
heavy metals	Metallic elements with high molecular weights, generally toxic in low concentrations to plants and animals.
home range	An area in which an individual animal spends most of its time doing normal activities.
hydraulic conductivity	A measure of the ease with which water moves through soil or rock; permeability.
hydric soil	A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic (waterloving) vegetation. Hydric soils that occur in areas having positive indicators of hydrophytic vegetation and wetland hydrology are wetland soils.
hydrophytic	A plant that grows either partly or totally submerged in water.

hydrostratigraphic	A body of rock having considerable lateral extent and composing a geologic framework for a reasonably distinct hydrologic system.
hyporheic zone	The subsurface volume of sediment and porous space adjacent to a stream through which water in a stream readily exchanges.
indicator species	Species of fish, wildlife, or plants which reflect ecological changes. Forest Service has identified animal species that are used to monitor the effects of planned management activities on viable populations of wildlife and fish. The indicator species for the Kootenai National Forest are: grizzly bear, gray wolf, bald eagle, peregrine falcon, elk, white-tailed deer, mountain goat, and pileated woodpecker.
interfinger (intertongue(ing))	A boundary that forms distinctive wedges, fingers or tongues between two different rock types
interim reclamation	Reclamation conducted during operations to reduce erosion, sedimentation, noxious weed invasion, and visual impacts. The reclamation may or may not be redisturbed at mine closure.
intermittent stream	A stream that does not flow continuously from its source to the mouth, at least for a portion of the year
intervisible	Mutually visible, or in sight, the one from the other, as stations.
intervisible turnout	An area designed to allow vehicles to pass and so spaced to provide visibility between the turnouts.
joint	Fracture in rock, generally more or less vertical or transverse.
kilovolt	One kilovolt equals 1,000 volts
kilowatt	One kilowatt equals 1,000 watts
kilowatt-hour	One kilowatt of power supplied to or taken from an electrical circuit for one hour
land application disposal	A method of disposing of waste water that relies on sprinkler application over a large area and/or percolation ponds. Disposed water may evaporate, be used by vegetation, or infiltrate to the ground water system.
leachate	A solution obtained by leaching, as in the downward percolation of water through tailings materials, and containing soluble substances.
liquefaction	When an earthquake occurs, energy released by rupturing in the earth's crust causes cyclic waves to travel through the rock and soil mass. Saturated soils can then experience enough pressure between the individual grains that the soil loses its cohesion (shear strength) and behaves as a liquid.
lithologic (lithology)	The character of a rock formation.
loading	Pertaining to the contribution of material or chemicals to a receiving stream.
loess	Wind blown soil deposits.
long term	A period greater than the life of the mine (*i.e.*, post closure).
macroinvertebrate	Small animals without backbones that are visible without a microscope, for example, insects, small crustaceans, and worms.
macrophytes	Plants visible to the unaided eye. In terms of plants found in wetlands, macrophytes are the conspicuous multicellular plants.
mainstem	The primary channel in a stream or river.

make-up water	Additional water required to supplement water lost during the milling process.
management area	Geographic areas, not necessarily contiguous, which have a common set of management requirements set by the KNF Forest Plan requirements and land allocations.
management indicator species	Any species, group of species, or species habitat element selected to focus management attention for the purpose of resource production, population recovery, maintenance of population viability, or ecosystem diversity.
management situations	Areas of grizzly bear or mountain goat habitat that due to their characteristics, have specific Forest Service management goals and directions.
maximum modification VQO	Management activities may be dominant, but appear natural when seen as background.
mean	The average number of a set of values.
median	A numerical value in the midpoint of a range of values with half the value points above and half the points below.
mesic	Intermediate or moderate moisture or temperature; or reference to organisms adapted to moderate climates.
mesothelioma	Form of cancer that is almost always caused by previous exposure to asbestos.
metapopulation	Multiple populations of an organism within an area in which interbreeding could occur, but does not due to geographic barriers.
metasedimentary	A rock type that is composed of formerly small-sized particles ("sedimentary," like the grains of sands on lakeshores) that are then exposed to high pressures and temperatures and become compacted into solid stone and are altered chemically.
metric	A value calculated from existing data and used for summarization purposes.
microseismic	A feeble rhythmically and persistently recurring earth tremor.
mitigation	An action to avoid, minimize, reduce, eliminate, replace, or rectify the impact of a management practice.
mixing zone	A limited area of a surface water body or a portion of an aquifer, where initial dilution of a discharge takes place and where water quality changes may occur and where certain water quality standards may be exceeded.
modification VQO	Management activities in foreground and middle-ground may be dominant, but appear natural.
montane	Pertaining to mountainous regions.
monzonite	An intermediate igneous intrusive rock composed of approximately equal amounts of sodic to feldspars
moving windows	A technique for measuring road densities on a landscape using a computerized Geographic Information System (GIS). The results are displayed as a percent of the analysis area in relevant route density classes.
mucking	To move or load muck.
mycorrhizae	Fungus root and the association, usually symbiotic, of specific fungi with the roots of higher plants.

neotropical migrant birds	Bird species that migrate to tropical areas such as Central or South America for the wintering months. Includes most of Montana's song birds.
nitrification/denitrification	A biological process for the conversion of ammonia compounds to nitrogen gas. The process is carried out in two steps. In the first step, nitrification, the ammonia compound is aerobically converted to nitrate by bacteria. In the second step, denitrification, nitrate is aerobically converted to nitrogen gas.
noxious weed	Any exotic plant species established or that may be introduced in the state that may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses or that may harm native plant communities.
old growth areas managed by the KFP	Areas are managed as MA 13. The goal of MA 13 is to maintain 10 percent on National Forest System lands below 5,500 feet within a major drainage in old growth condition. The KFP direction is to provide a diversity of types of old growth units located throughout a drainage, ranging in size from 100 to 1,200 acres, with occasional units as small as 50 acres. Also see "effective old growth."
old growth dependent species	Those species that can only survive in old growth habitats, or that need old growth for some critical portion of their life cycle.
old growth ecosystems	Old growth ecosystems can be defined by elements of structure, function, and composition. Structure includes large live and dead old-growth trees, and fallen dead trees on land and in streams. Function refers to the mechanisms and rates of ecological processes, including high primary productivity (photosynthesis), high respiratory rates relative to younger stands, a "shifting-mosaic steady state" of living biomass, and large accumulations of dead organic matter. Composition refers to the species of plants and animals present in old growth ecosystems, including old growth dependent or associated species.
ore	A naturally occurring mineral containing a valuable constituent for which it is mined and worked.
overburden	Geologic material of any nature that overlies a deposit of ore or coal.
palustrine system wetland	Palustrine system wetlands are traditionally called marshes, swamps, bogs, or fens. They include all non-tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 percent.
partial retention VQO	Management activities remain visually subordinate.
patio	The level area immediately outside the adit portal, built of fill to provide a work area, and access to the mine area.
peak flow	The greatest attained water flow in a specified period of time.
perennial stream	A stream that flows throughout the year, and from source to mouth.
periphyton	Organisms (as some algae) that live attached to underwater surfaces.
permeable	Allowing the passage of fluids.

permeameter	Device used to measure the permeability of soil, sediment or rock. Permeability is the capacity of a porous rock, sediment or soil to transmit a fluid.
phreatic surface	The boundary between saturated and unsaturated soil zone in an aquifer.
pillar	A column of rock retained for structural support in a mine.
piping	Creation of tunnels or cavities from the movement of water in soil.
planning sub-unit	An analysis area based on watersheds to be used for certain wildlife species in the Forest Plan and NEPA analysis.
planning unit	A geographic area based on sub-basins or fourth level hydrologic units, as recognized by the U.S. Geological Survey, used by the Forest Service for natural resources planning.
Pleistocene	The first epoch of the Quarternary Period in the Cenozoic Era with respect to the age of the earth. Characterized by the spreading and recession of the ice sheets, and by the appearance of modern man.
population	A collection of individuals that share a common gene pool. In this document, local population refers to those breeding individuals within the analysis area.
portal	Surface entrance to a mine, particularly to a tunnel or adit.
Precambrian	All rocks formed before Cambrian time.
preservation VQO	Only ecological or minimal changes permitted.
pressure filtration	A water treatment system that uses a filter in conjunction with a pump.
probable maximum flood	The flood resulting from Probable Maximum Precipitation; the largest flood event theoretically possible.
quartzite	A rock that has formed as a result of the hardening of sediments by pressure and heat. A granular metamorphic rock consisting essentially of sand-sized particles and quartz.
rain-on-snow event	A meteorological occurrence in the months of December through February during which the heat contained in rainfall melts the existing snow cover producing large amounts of runoff and high streamflows in a short time frame.
raise	A vertical underground tunnel.
raise	Incremental increases in the height of a dam.
reach	An extended portion of river with uniform characteristics.
reagents	A substance used (as in detecting or measuring a component, in preparing a product, or in developing photographs) because of its chemical or biological activity.
reclamation	The concept of reclamation of land has been defined as including all desirable and practical methods for: (a) designing and conducting a surface disturbance in a manner that minimizes the effect of the disturbance and enhances the reclamation potential of the disturbed lands; (b) handling surficial material in a manner that ensures a root zone that is conducive to the support of plant growth where required for future use; and contouring the surface to minimize hazardous conditions, to ensure stability, and to protect the surface against wind or water erosion.
redd	A fish spawning nest.

regeneration	Regrowth of a tree crop, or other vegetation, whether by natural or artificial means.
regeneration harvest	Removal of an existing stand to prepare the site for regeneration. Clearcut, shelterwood and seed tree harvests are examples of regeneration treatments.
replacement old growth	Older age class stands that have some of the characteristics of old growth but not all of them. Used for stands that are managed as old growth in compartments that lack the minimum amount of old growth.
resistivity	The thermal resistance of unit area of a material of unit thickness to heat flow caused by a temperature difference across the material. (m^2K/W)
retention VQO	Management activities are not visually evident to the casual observer.
riparian	Areas with distinct resource values and characteristics that are comprised of an aquatic ecosystem, and adjacent upland areas that have direct relationships with the aquatic system. This includes floodplains, wetlands, and lake shores.
ripped	To tear, split apart, or open.
riprap	A foundation or sustaining wall of stones or chunks of concrete thrown together without order to prevent erosion.
rock fragment	Rock that is larger than 2 millimeters (about 1/16 inch) in diameter.
salmonid	Member of the fish family Salmonidae; includes salmon and trout.
sedge	A grass-like plant, often associated with moist or wet environments.
seepage collection system	The system of drains, ponds, and pumps to collect and return tailings dam embankment seepage.
segregation	The separation of water from sources of contamination in a mine.
seismic	Of, or produced by, earthquakes.
sensitive species	Those species, plant and animal identified by the Regional Forester for which population viability is a concern, as evidenced by: 1) significant current or predicted downwards trend in population numbers or density or 2) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.
short term	A period of time less than 35 years (*i.e.*, operational period).
side slope	The slope of an embankment or waste dump.
siltite	A hard, metamorphic rock, intermediate between shale and slate, was originally silts.
slimes	A product of wet crushing consisting of wet particles that will pass a 200-mesh screen.
slurry	A mixture of fine-grained solid material and water used to allow pumping as a way to transport the solid material over long distances.
soil erodibility	A measure of the inherent susceptibility of a soil to erosion, without regard to topography, vegetation cover, management, or weather conditions.

sorb	Remove solutes from the fluid phase and concentrate them on the solid phase of a medium either by absorption or adsorption.
stability	The ability of a population to remain at about the same population size over time through stable natality and mortality rates.
piezometer	A small well used to locate the water table.
starter dam	Earthen dams built of borrow material to initiate construction of the tailings impoundment.
stope	Step-like underground excavation for removal of ore in successive layers.
stratabound	A mineral deposit confined to a single stratigraphic unit.
stratigraphy	The arrangement of strata.
stratum	A section of a formation that consists of primarily the same rock type.
subpopulation	A well-defined set of interacting individuals that comprise a portion of a larger, interbreeding population.
subsidence	The sudden sinking or gradual downward settling of the earth's surface with little or no horizontal motion.
sustainability	The ability of a population to maintain a relatively stable population size over time.
syncline	A sharply arched fold of stratified rock from whose central axis the strata slope upward in opposite directions: opposed to anticline.
tackifier	An agent that binds seed, fertilizer, and mulch to a site, often used when seeding slopes.
taxon	Any formal taxonomic group such as genus, species, or variety.
Tertiary	The earlier of two geologic periods comprised in the Cenozoic Era, in the classification generally used. Also, the system of strata deposited during that time period.
threatened	Any species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, as identified by the Secretary of the Interior in accordance with the 1973 Endangered Species Act.
total suspended solids	Undissolved particles suspended in liquid.
transect	A line, strip, or series of plots from which biological samples, such as vegetation, are taken.
unconsolidated	Loose or soft.
upgradient	A direction characterized by higher fluid potential or hydraulic head.
viability	Ability of a population to maintain sufficient size so that it persists over time in spite of normal fluctuations in numbers; usually expressed as a probability of maintaining a specific population for a specific period.
viewshed	The portion of the surrounding landscape that is visible from a single observation point or set of points.
visual absorption level	A classification used in the Forest Service Scenery Management System to denote the relative ability of a landscape to accept human alterations without loss of character of scenic quality.

visual quality objective	A desired level of scenic quality based on physical and sociological characteristics of an area. Refers to the degree of acceptable alterations of the characteristic landscape.
waste rock	Rock that does not contain a valuable constituent at concentrations suitable for mining.
waterbars	A shallow ditch dug across a road at an angle to prevent excessive flow down the road surface and erosion of road surface materials.
waters of the U.S.	Waters that include the following: all interstate waters; intrastate waters used in interstate and/or foreign commerce; tributaries of the above; territorial seas at the cyclical high tide mark; and wetlands adjacent to all the above.
wetlands	Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.
zone of influence	The area outside the physical workings of the mine and related facilities that is affected by noise, pollution, encroachment, or other disturbances caused by mining activities.

Chapter 8. References

Adamus, PP.R., E.J. Stockwell, M.E. Clairain, Jr., L.PP. Morrow, R.D. Rozas, and R.D. Spith. 1991. Wetland Evaluation Technique (WET). Volume I. Literature review and evaluation rationale. U.S. Army Corps of Engineers, Waterways Experiment Station. Wetlands Research Program, Technical Report WRP-DE-2.

Agapito Associates, Inc. 2007a. Evaluation of Alternative Plant Sites in Libby Creek, Montanore Project, Lincoln County, Montana. Prepared for ERO Resources Corporation. On file with the KNF and the DEQ. pp. 7.

Agapito Associates, Inc. 2007b. Evaluation of Subsidence Potential Montanore Project. Prepared for ERO Resources Corporation. On file with the KNF and the DEQ. pp. 32.

Agapito Associates, Inc. 2008. Backfilling Pre-Feasibility Study, Montanore Project. Prepared for ERO Resources Corporation. On file with the KNF and the DEQ. pp. 18.

Apps, C.D. 2000. Space-use, diet, demographics, and topographic associations of lynx in the southern Canadian Rocky Mountains: a study. Pp. 351-371. *In* Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey, and J.R. Squires (tech. eds.). Ecology and conservation of lynx in the United States. University Press of Colorado. Boulder, CO. 480 pp.

Asher Sheppard Consulting. 2007. Electric and magnetic fields of electric power transmission lines and substations: public health issues and analysis of Montanore Project alternatives. Submitted to the KNF and the DEQ. pp. 35.

Askins, R. A. 2000. Restoring North America's Birds: Lessons from Landscape Ecology. Yale University Press. 319 pp.

Austin, M. 1998. Wolverine winter travel routes and response to transportation corridors in Kicking Horse Pass between Yoho and Banff National Parks. M.S. thesis, University of Calgary, Alberta, Canada. 40 pp.

Avian Power Line Interaction Committee (APLIC). 1994. Mitigating bird collisions with power lines: the state of the art in 1994. Edison Electric Institute and the Raptor Research Foundation. Washington, DC.

Avian Power Line Interaction Committee (APLIC). 2006. Suggested practices for avian protection on power lines: the state of the art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, DC and Sacramento, CA.

Avista Corporation. 2007. 2006 Annual Report Implementation of PM and E Measures. The Clark Fork Project, FERC Project Number 2058. Spokane, WA.

Bain, M.B. and N.J. Stevenson, editors. 1999. Aquatic Habitat Assessment: Common Methods. American Fisheries Society. Bethesda, MD.

Banci, V. 1994. Wolverine. Chapter 5 *In* Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski. (tech. eds.). The Scientific Basis for Conserving Forest Carnivores American Marten, Fisher, Lynx and Wolverine in the Western United States. General Technical Report RM-254. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO. 184 pp.

Barbour, M.T., J. Gerritsen, B.D. Synder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, 2nd Edition. EPA 841-B-99-002. EPA, Office of Water. Washington, DC.

Bartelt, P.E. and C.R. Peterson. 1994. Riparian habitat utilization by western toads (*Bufo boreas*) and spotted frogs (*Rana pretiosa*) on the Targhee National Forest. Final Report, July 11. Department of Biological Sciences, Idaho State University, and Idaho Museum of Natural History.

Bate, L.J. and M.J. Wisdom. 2004. DRAFT – Snag, large tree and log resources in relation to roads and other indices of human access on the Flathead National Forest. Progress Report July 2002. 31 pp.

Baty, G.R. 1995. Resource partitioning and browse use by sympatric elk, mule deer and white-tailed deer on a winter range in western Montana. M.S. thesis, University of Montana. Missoula, MT. 228 pp.

Belt, G.H., J. O'Laughlin, and T. Merrill. 1992. Design of Forest Riparian Buffer Strips for the Protection of Water Quality: Analysis of Scientific Literature. Idaho Forest, Wildlife and Range Policy Analysis Group Report Number 8. University of Idaho.

Bennett, E.H. 1984. A hypothesis concerning the genesis of orebodies in the Coeur d'Alene Mining District, Idaho. Idaho Geological Survey Technical Report 84-7, pp. 39.

Berkman, H.W. and C.F. Rabeni. 1987. Effect of siltation on stream fish communities. Environmental Biology of Fishes 18(4):285-294.

Bernall, S. and L. Lockard. 2008. Upstream Fish Passage Studies Annual Progress Report - 2007, Fish Passage / Native Salmonid Program, Appendix C. Report to Avista Corporation, Spokane, Washington. U.S. Fish and Wildlife Service, Creston, Montana and Avista Corporation, Noxon, Montana (in preparation).

Beuhler, D.A., T.J. Mersmann, J.D. Fraser, and J.K.D. Seeger. 1991. Effects of human activity on bald eagle distribution on the Northern Chesapeake Bay. Journal of Wildlife Management 55:282-290.

Big Sky Acoustics. 2006. Revised Montanore Project Environmental Noise Study. Submitted to the KNF and the DEQ. pp. 14 plus figures and appendices.

Bjornn, T.C., C.A. Peery, and L.M. Garmann. 1998. Deposition of fine sediments in substrates and their effect on survival of trout embryos. Technical Report 98-1. Completion Report Project INT-91609-RJVA. Prepared for Rocky Mountain Research Station. Idaho Cooperative Fish and Wildlife Research Unit. Moscow, ID.

Board of Health and Environmental Sciences. 1992. Order adopting the Montana Department of Health and Environmental Sciences' recommendation to permit a change in the quality of ambient waters. On file with the DEQ.

Boleneus, D.E., L.M. Appelgate, J.H. Stewart, and M.L. Zientek. 2005. Stratabound Copper-Silver Deposits of the Mesoproteozoic Revett Formation, Montana and Idaho. USGS Scientific Investigation Report 2005-5231.

Boleneus, D.E., L.M. Applegate, N.L. Joseph, and T.R. Brandt. 2001. Raster images of geologic maps of middle Proterozoic belt strata in parts of Benewah, Bonner, Kootenai, and Shoshone counties, ID; and Lincoln, Mineral, and Sanders counties, MT: USGS Open-File Report, 01-0438. pp. 38.

Bonneville Power Administration. 2006. Final System Impact Study, Montanore Mine Project Load, Flathead Electric Cooperative, Inc. Network Planning, BPA. Submitted to the KNF and the DEQ. pp. 10 plus appendices.

Bonneville Power Administration. 2008. Sedlak Park Wetlands Identification. Email correspondence from Gene Lynard. Submitted to the KNF and the DEQ.

Boore, D.M., W.B. Joyner, and T.E. Fumal. 1997. Equations for Estimating Horizontal Response Spectra and Peak Acceleration from Western North American Earthquakes: A Summary of Recent Work, Seismological Research Letters 68(1):128-153.

Brandborg, S.M. 1955. Life history and management of the mountain goat in Idaho. Wildlife Bulletin No. 2. Idaho Department of Fish and Game. Boise, ID. 142 pp.

Bratkovich, A. 2006. Wildlife Biologist, KNF. Personal communication with Karen Baud, Wildlife Biologist, ERO Resources Corporation. KNF, Project Record, Montanore Project. February 16.

Bratkovich, A. 2008. Wildlife Biologist, KNF. Information provided to ERO Resources Corporation in comment on internal draft document. KNF, Project Record, Montanore Project. August 7.

Brinson, M. 1993. A Hydrogeomorphic Classification for Wetlands. Wetlands Research Program Technical Report WRP-DE-4. US Army Corps of Engineers. pp 79.

Brown, J. 2005. Montana Fish, Wildlife, and Parks. Personal communication with A. Bratkovich, Wildlife Biologist, KNF.

Brown, J. 2007. Montana Fish, Wildlife, and Parks. Personal communication with K. Baud, Wildlife Biologist, ERO Resources Corporation. September 21.

Brown, J. 2008. Montana Fish, Wildlife, and Parks. Personal communication with K. Baud, Wildlife Biologist, ERO Resources Corporation. April 30, September 11, and September 15.

Bull, E.L. 1975. Habitat utilization of the pileated woodpecker, Blue Mountains, Oregon. M.S. thesis, Oregon State University. Corvallis, OR.

Bull, E.L. 1980. Resource partitioning among woodpeckers in northeastern Oregon. Ph.D. dissertation, University of Idaho. Moscow, ID.

Bull, E.L. 1987. Ecology of the pileated woodpecker in northeastern Oregon. Journal of Wildlife Management, 51 (2): 472-481.

Bull, E. L., A. L. Wright, and M. G. Henjum. 1990. Nesting habitat of Flammulated Owls in Oregon. Journal of Raptor Research 24: 52-55.

Bull, E.L., R.C. Beckwith, and R.S. Holthausen. 1992a. Arthropod diet of pileated woodpeckers in northeastern Oregon. Northwestern Naturalist 73 (2): 42-45.

Bull, E.L., R.S. Holthausen, and M.G. Henjum. 1992b. Roost trees used by pileated woodpeckers in northeastern Oregon. Journal of Wildlife Management 56 (4): 786-793.

Bull, E.L. and R.S. Holthausen. 1993. Habitat use and management of pileated woodpeckers in northeastern Oregon. Journal of Wildlife Management. 57: 335-345.

Bull, E. L., and J. E. Jackson. 1995. Pileated Woodpecker (*Dryocopus pileatus*). In *The Birds of North America, No. 148* (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA. and The American Ornithologists' Union, Washington, D.C.

Bull, E.L. and E.C. Meslow. 1977. Habitat requirements of the pileated woodpecker in northeastern Oregon. Journal of Forestry, 75 (6): 335-337.

Bull, E.L., A.D. Twombly, and T.M. Quigley. 1980. Perpetuating snags in managed mixed conifer forests of the Blue Mountains, Oregon. pp. 325-334. *Management of western forests and grasslands for nongame birds,* R. M. DeGraaf (tech. coordinator), USDA Forest Service, Intermountain Forest and Range Experiment Station, INT-GTR-86. Ogden, UT.

Bureau of Reclamation. 1977. Design of Small Dams. USGPO, 1973/1977, revised reprint of 2nd edition.

Bury, R.B. 1983. What we know and do not know about off-road vehicle impacts on wildlife. In R.N.L. Andrews & P.P. Nowak (eds.) Off-road vehicle use: A management challenge conference. Washington, DC. pp. 110-122.

Buskirk, S.W., L.F. Ruggiero, and C.J. Krebs. 2000. Habitat fragmentation and interspecific competition: implications for lynx conservation. pp. 83-100. *In* Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey, and J.R. Squires (tech. eds.). Ecology and conservation of lynx in the United States. University Press of Colorado. Boulder, CO. 480 pp.

Buterbaugh, G.L. 1991. Biological Opinion on the effects to grizzly bears and grey wolf from the implementation of proposed timber harvest in the Grouse Keeler Timber Sale (Compartment 40), KNF. Libby, MT. USDI Fish and Wildlife Service. Denver, CO. July 22.

Butts, T.W. 1992. Wolverine (*Gulo gulo*) Biology and Management: A literature review and annotated bibliography. USDA Forest Service, Region 1, Missoula, MT. 106 pp. plus attachments.

Call & Nicholas, Inc. 2005a. Reevaluation of room-and-pillar mining layout at Rock Lake. Memorandum to McIntosh Engineering. Submitted to the KNF and the DEQ. pp. 6.

Call & Nicholas, Inc. 2005b. Troy Sinkhole Evaluation. Memorandum to Genesis Troy Mine, July 28. Submitted to the KNF and the DEQ. pp. 17.

Call & Nicholas, Inc. 2006. Montanore subsidence evaluation. Memorandum to McIntosh Engineering. Submitted to the KNF and the DEQ. pp. 8.

Camp, Dresser, and McKee. 1991. Final Report: Soil Attenuation and Tailing Water Quality, Montanore Project. Report prepared for Noranda Minerals Corporation. August.

Casebeer, R.L., M.J. Rognrud and S. Brandborg. 1950. Rocky Mountain goat in Montana. Montana Fish and Game Commission, Wildlife Restoration Division. Pittman-Robertson Federal Aid Project Bulletin No. 5. 107 pp.

Cassirer, E.F., C.R. Groves, and D.L. Genter. 1994. Coeur d'Alene salamander Conservation Assessment. USDA Forest Service, Region 1. Missoula, MT. 55 pp.

Castaneda, B. 2004. Old Growth Management. 1900/2600 letter, April 26, 2004. USDA Forest Service, KNF, Libby, MT. 1 pg. + 61 pp attachment: "KNF Considerations for the Management of Old-Growth."

Chadwick Ecological Consultants, Inc. 2000. Fisheries survey of the Bull River Drainage, Montana. Prepared for Avista Corporation. Spokane, WA.

Chen, J., J.F. Franklin and T.A. Spies. 1995. Growing-season microclimatic gradients from regeneration harvest edges into old-growth Douglas-fir forests. Ecological Applications, Volume 5, Number 1 74-86.

Chen-Northern, Inc. 1989. Water resources baseline inventory, Montana Project. *In* Amended application for a hard rock operating permit and amended plan of operations. Mines Management, Inc. 2005. Appendix B.

Chen-Northern, Inc. 1990. Interim monitoring program, water resources summary report, April 1989 through February 1990. Submitted to the Montana Department of State Lands.

Chen-Northern, Inc. 1991. 1990 Interim water resources monitoring program, summary report, April 1990 through February 1991. Submitted to the Montana Department of State Lands.

Chen-Northern, Inc. 1992. 1991 Interim water resources monitoring program, summary report, April 1991 through February 1992. Submitted to the Montana Department of State Lands.

Chen-Northern, Inc. 1993. 1992 Water resources monitoring program, summary report, April 1992 through October 1992. Submitted to the Montana Department of State Lands.

Cherry, M.B. 1997 (unpublished). The Black-backed and Three-toed Woodpeckers: Life History, Habitat Use, and Monitoring Plan. Gallatin National Forest. Bozeman, MT. 22 pp.

Christensen, A.G. and M.J. Madel. 1982. Cumulative effects analysis process – Grizzly bear habitat component mapping. KNF. Libby, MT. 38 pp.

Christy, R.E., and S.D. West. 1993. Biology of bats in Douglas-fir forests. USDA Forest Service. Pacific Northwest Research Station. General Technical Report. PNW-GTR 308. 28 pp.

Claar, J.J., N. Anderson, D. Boyd, M. Cherry, B. Conard, R. Hompesch, S. Miller, G. Olson, H. Ihsle Pac, J. Waller, T. Wittinger, and H. Youmans. 1999. Carnivores. Pages 7.1-7.63 *In* Joslin, G. and H. Youmans, coordinators. Effects of recreation on Rocky Mountain wildlife: A Review for Montana. Committee on Effects of Recreation on Wildlife. Montana Chapter of the Wildlife Society. 307 pp.

Clark, J.R. 2000. Endangered and Threatened Wildlife and Plants: Determination of Threatened Status for the Contiguous U.S. Distinct Population Segment of the Canada Lynx and Related Rule; Final Rule. USDI Fish and Wildlife Service. *Federal Register*, March 24. Vol. 65:58. pp 16051-16086.

Clark, A.L. 1971. Strata-Bound Copper Sulfides in the Precambrian Belt Supergroup, Northern Idaho and Northwestern Montana, Society Mining Geology Japan, Special. Issue 3, 261-267, in International Mineralogical Association International Association on the Genesis of Ore Deposits (IMA-IAGOD) Meetings 1970, IAGOD Vol. 1.

Cook, J.G., L.L. Irwin, L.D. Bryant, R.A. Riggs, and J.W. Thomas. 1998. Relations of forest cover and condition of elk: a test of the thermal cover hypothesis in summer and winter. Wildlife Monographs 141.

Copeland, J.P. 1996. Biology of the wolverine in central Idaho. M.S. thesis, University of Idaho. 138 pp.

Corn, P., P. Hendricks, T. Koch, B. Maxell, C. Peterson, and K. Werner. 1998. Unpublished letter to Forest Service Region 1 Species at Risk Task Group: subject – Boreal toad (*Bufo boreas boreas*) listing as a sensitive species for all Region 1 Forests. 8 pp.

Council of Environmental Quality. 1997. Environmental Justice, Guidance under the National Environmental Policy Act. Available at: <http://ceq.eh.doe.gov/nepa/regs/ej/justice.pdf>.

Cowardin, L.M., V. Carter, F.C. Golet, E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. 131pp.

Davidson, J. 1987. Ground Stability Investigation, Troy Mine–(ID No. 24-01467). MSHA Safety and Health Technology Center, Ground Support Division. Denver, CO. November 17. 7 pp.

deMaynadier, P.G., and M.L. Hunter, Jr. 1998. Effects of silvicultural edges on the distribution and abundance of amphibians in Maine. Conservation Biology 12(2):340-352.

Department of Environmental Quality. 1996. Geochemical comparison of two very similar stratabound copper sulfide orebodies in Northwest Montana, DEQ Geochemical Report for ASARCO Rock Creek Project.

Department of Environmental Quality. 1997. Authorization to discharge under the Montana pollutant discharge elimination system (MPDES). On file with the DEQ. pp. 20.

Department of Environmental Quality. 2006. Preliminary determination-air quality permit. pp. 38. Available at: http://www.deq.state.mt.us/AirQuality/ARM_Permits/3788-00.pdf.

Department of Environmental Quality. 2007. State of Montana Modeling Guideline for Air Quality Permit Applications. Available at: www.deq.state.mt.us/AirQuality/Montana%20Modeling%20Guideline%20for%20Air%20Quality%20Permits%20(3).pdf

Department of Environmental Quality. 2008a. Circular DEQ-7: Montana Numeric Water Quality Standards. Available at: www.deq.state.mt.us/wqinfo/Standards/CompiledDEQ-7.pdf.

Department of Environmental Quality. 2008b. Recently collected water quality data from Troy Mine, Lincoln County, MT. Laboratory data and discussion from Wayne Jepson to Barbara Galloway at ERO Resources Corporation. October.

Department of Natural Resources and Conservation (DNRC). 1993. Certificate of Environmental Compatibility and Public Need, Montanore Project. On file with the DEQ.

Department of Natural Resources and Conservation (DNRC). 2008. Information and Instructions for Application for Beneficial Water Use Permit. Form No. 600 and Criteria Addendum A. Water Rights Division, Water Rights Bureau. Available at: <http://dnrc.mt.gov/wrd/water_rts/wr_general_info/wrforms/600-ins.pdf>.

Department of State Lands. 1992. Record of Decision, Montanore Project. On file with the DEQ.

Department of State Lands. 1993. Montanore Operating Permit #00150. On file with the DEQ. pp. 30.

Dood, A.R., S.J. Atkinson, and V.J. Boccadori. 2006. Grizzly Bear Management Plan for western Montana: Final Programmatic Environmental Impact Statement 2006-2016. Montana Fish, Wildlife, and Parks. Helena, MT. pp. 163.

Dunnigan, J., B. Marotz, J. DeShazer, L. Garrow, and T. Ostowski. 2003. Mitigation for the Construction and Operation of Libby Dam, Annual Report, 2001-2002, Montana Fish, Wildlife, and Parks. Project Number 199500400, Agreement DE-A179-83-BP12660. Funded by Bonneville Power Administration. June.

Dunnigan, J., J. DeShazer, L. Garrow, T. Ostowski, and B. Marotz. 2004. Mitigation for the Construction and Operation of Libby Dam, Annual Report 2003. Project Number 199500400, Agreement DE-A179-83-BP12660. Montana Fish, Wildlife and Parks. Funded by Bonneville Power Administration. June.

Dunnigan, J., J. DeShazer, L. Garrow, T. Ostowski, and B. Marotz. 2005. Mitigation for the Construction and Operation of Libby Dam, 2004-2005 Annual Report. Project Number 199500400. Funded by Bonneville Power Administration. pp. 148. June.

Edwards, M. 2005. Ranger, KNF. Personal communication with Julia Grant, Natural Resource Specialist, ERO Resources Corporation. October 24 and 25. KNF, Project Record, Montanore Project.

Eisler, R. 2000. Handbook of Chemical Risk Assessment Health Hazards to Humans, Plants, and Animals. Volume 1 Metals. Lewis Publishers, Boca Raton, FL. pp. 652-675.

Electric Power Research Institute. 2006. T&D System Design and Construction for Enhanced Reliability and Power Quality. Report No. 1010192. Palo Alto, CA.

Enviromin. 2007. Summary of Geochemical Data for the Rock Creek-Montanore Stratabound Cu-Ag Deposit. Technical Report submitted to ERO Resources Corporation. Submitted to the KNF and the DEQ. pp. 42.

Environmental Laboratory. 1987. Corps of Engineers Wetland Delineation Manual, Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station. Vicksburg, MS.

Environmental Protection Agency. 1993. Applicability of 40 CFR 440 Effluent Limitations Guidelines to discharges from active ore (metal) mining and dressing sites. On file with the DEQ.

Environmental Protection Agency. 1996. 1995 Updates: Water Quality Criteria Documents for the Protection of Aquatic Life in Ambient Water. EPA-820-B-96-001. Office of Water. Washington, DC.

Environmental Protection Agency. 1998. Final Guidance for Consideration of Environmental Justice in EPA's NEPA Compliance Analyses. Washington, DC. Available at: <www.epa.gov/oecaerth/resources/policies/ej/ej_guidance_nepa_epa0498.pdf >.

Environmental Protection Agency. 1999. Final Guidance for Consideration of Environmental Justice in Clean Air Act 309 Reviews. Washington, DC. Available at: <http://www.epa.gov/compliance/resources/policies/nepa/enviro_justice_309review.pdf>.

Environmental Protection Agency. 2000. Ambient Water Quality Criteria Recommendations. Information Supporting the Development of State and Tribal Nutrient Criteria for River and Stream in Nutrient Ecoregion II. EPA-822-B-00-015. Office of Water. Washington, DC.

Environmental Protection Agency. 2001. Water Quality Criterion for the Protection of Human Health: Methylmercury. EPA-823-R-01-001. Office of Water. Office of Science and Technology. Washington, DC.

Environmental Protection Agency. 2002. Wastewater Technology Fact Sheet: Slow Rate Land Treatment. Office of Water. EPA 832-F-02-012. September 2002. pp. 2.

Environmental Protection Agency. 2006a. National Ambient Air Quality Standards (NAAQS). Available at: <www.epa.gov/air/criteria.html>.

Environmental Protection Agency. 2006b. Process design manual: land treatment of municipal wastewater effluents. EPA/625/R-06/016.

Environmental Protection Agency. 2007. Aquatic Life Ambient Freshwater Quality Criteria-Copper. 2007 Revision. EPA -822-R-07-001. Office of Water. Washington, DC.

ERO Resources Corporation. 2005. Scoping report, Montanore Project EIS. Submitted to the KNF and the DEQ. pp. 9 plus appendices.

ERO Resources Corporation. 2006a. Issue statements and analysis guidance. Submitted to the KNF and the DEQ. pp. 43.

ERO Resources Corporation. 2006b. Transmission line screening analysis report, Montanore Project EIS. Submitted to the KNF and the DEQ. pp. 15 plus figures and appendices.

ERO Resources Corporation. 2007. Make-up water well locations. Submitted to the KNF and the DEQ. pp. 5.

ERO Resources Corporation. 2008a. Montanore tailings impoundment watershed analysis. pp. 6 plus figures.

ERO Resources Corporation. 2008b. Hydrogeology Technical Report, Montanore Mine Area. Submitted to the KNF and the DEQ. pp. 41 plus appendices.

Federal Land Managers' Air Quality Related Values Workgroup. 2000. Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report. USDA Forest Service-Air Quality Program, USDI National Park Service-Air Resources Division, USDI Fish and Wildlife Service-Air Quality Branch. December.

Fraley, J.J. and B.B. Shepard. 1989. Life History, Ecology, and Population Status of Migratory Bull Trout (*Salvelinus confluentus)* in the Flathead Lake and River System, Montana. Northwest Science 63(4):133-143.

Frederick, G.P. 1991. Effects of forest roads on grizzly bears, elk and gray wolves: a literature review. USDA Forest Service, Kootenai NF. Libby, MT. 53 pp.

Galloway, M. 1977. Qualitative Hydrogeologic Model of Thermal Springs in Fractured Crystalline Rock. M.S. thesis. Montana State University, Bozeman, MT. pp. 197.

GEI Consultants, Inc. 2005. Lower Clark Fork River drainage habitat problem assessment. Report to Avista Corporation, Spokane, Washington.

Genesis Inc. 2000. Benthic Macroinvertebrate and Stream Monitoring Program for Streams Adjacent to Genesis's Troy, Montana Unit. Completion Report for October 2000.

Genesis Inc. 2001. Benthic Macroinvertebrate and Stream Monitoring Program for Streams Adjacent to Genesis's Troy, Montana Unit. Completion Reports for Spring and Fall 2001.

Geomatrix Consultants, Inc. 2006a. Water resources report for CMW Area, Montanore Mine Project. Submitted to the KNF and the DEQ. pp. 37 plus appendices.

Geomatrix Consultants, Inc. 2006b. Analysis of conceptual tailings impoundment diversion drainage alternatives, Montanore Mine Project. Submitted to the KNF and the DEQ. pp. 41 plus appendices.

Geomatrix Consultants, Inc. 2006c. Hydrogeology report, Montanore Mine Project. Submitted to the KNF and the DEQ. pp. 58 plus appendices.

Geomatrix Consultants, Inc. 2006d. Water resources report for baseline conditions, Montanore Mine Project. Submitted to Mines Management, Inc. pp. 82 plus appendices.

Geomatrix Consultants, Inc. 2007a. Supporting water resources information for MPDES permit application, Montanore Mine Project. Submitted to the KNF and the DEQ. pp. 126 plus appendices.

Geomatrix Consultants, Inc. 2007b. Waste rock management plan, Montanore Mine Project. Submitted to the KNF and the DEQ. pp. 19 plus appendices.

Geomatrix Consultants, Inc. 2007c. Evaluation of predicted ground water inflow rates to adits and underground mine workings for Montanore Mine Site. Memorandum to Michael Galloway, Senior Hydrogeologist, ERO Resources Corporation. Submitted to the KNF and the DEQ.

Geomatrix Consultants, Inc. 2007d. Geomatrix conceptual model of ground water flow for the Montanore mine site ground water model. Memorandum to Michael Galloway, Senior Hydrogeologist, ERO Resources Corporation. Submitted to the KNF and the DEQ.

Geomatrix Consultants, Inc. 2007e. Survey of wetlands, sensitive plants, and amphibian/reptiles in alternative sites for tailings impoundment, plant facility and mine tunnel, Montanore Mine Project. Prepared for Montanore Minerals Corp. Submitted to the KNF and the DEQ. pp.15 plus appendices.

Geomatrix Consultants, Inc. 2007f. Water Quality Database, Montanore Mine Project. Prepared for Montanore Minerals Corp. Submitted to the KNF and the DEQ.

Geomatrix Consultants, Inc. 2008a. Revised water balance for “steady-state” mine and adit inflow conditions, Montanore Project. Memorandum to Eric Klepfer (MMC). Submitted to the KNF and the DEQ. pp 4.

Geomatrix Consultants, Inc. 2008b. Groundwater flux calculations at LAD Areas, Montanore Mine Site. Memorandum to Eric Klepfer (MMC). Submitted to the KNF and the DEQ. pp 4.

Geomatrix Consultants, Inc. 2008c. Functional analysis for wetlands in proposed mitigation sites, Montanore Mine Project, Montana. Memorandum to Eric Klepfer (MMC). Submitted to the KNF and the DEQ. pp. 8.

Geomatrix Consultants, Inc. 2008d. Waters of the U.S. Delineation for Little Cherry Creek Tailings Impoundment and Creek Diversion, Montanore Mine Project, Montana. Prepared for Montanore Minerals Corp. Submitted to the KNF and the DEQ. pp. 32 plus appendices.

Georgia Department of Natural Resources. 2006. Guidelines for Slow-Rate Land Treatment of Wastewater. Environmental Protection Division, Watershed Protection Branch, Atlanta, Georgia. June. pp. 58.

Gibson, R. 1948. Geology and ore deposits of the Libby quadrangle, Montana, with sections on Pleistocene glaciation by W.C. Alden and Physiography by J.T. Pardee: U.S. Geological Survey Bulletin 956. pp. 131.

Glasgow Engineering Group, Inc. 2008. Montanore EIS, Alternative 3 Tailings Site (Poorman Creek), Feasibility Stability Evaluation. Letter report to ERO Resources Corporation.

Golder Associates. 1996. Evaluation of surface paste placement as an alternative tailings management strategy. Report prepared for ASARCO, Inc. Submitted to the KNF and the DEQ.

Graham, R.T., A.E. Harvey, M.F. Jurgensen, T.B. Jain, J.R. Tonn, and D.S. Page-Dumroese. 1994. Managing coarse woody debris in forests of the Rocky Mountains. Research Paper INT-RP-477. Ogden, UT. USDA Forest Service Intermountain Research Station. 12 pp.

Grant, G.E., B. Wemple, and F. Swanson (tech. eds.). 1998. Forest Service Roads: A synthesis of scientific information (DRAFT). Pacific NW Research Station. Corvallis, OR.

Green, P.P., J. Joy, D. Sirucek, W. Hann, A. Zack, and B. Naumann. 1992. Old-Growth Forest Types of the Northern Region (errata corrected 2005). USDA Forest Service, Region 1, Missoula, MT.

Grindal, S.D. 1995. Habitat use by bats in fragmented forest. pp. 260-272 in: Bats and Forests Symposium. R. Barclay and R. Brigham Eds. British Columbia Ministry of Forests, Victoria, B.C. 291 pp.

Gurrieri, J. 2001. Hydrology and chemistry of wilderness lakes and evaluation of impacts from proposed underground mining, CMW, Montana. Montana DEQ, Helena, MT. pp. 57 plus appendix.

Gurrieri, J. 2007. Regional geologist, USDA Forest Service, Intermountain Region, Ogden, Utah. Personal communication with Michael Galloway, senior hydrogeologist, regarding ground water storage in surficial deposits in upper portion of drainages. ERO Resources Corporation. September.

Gurrieri, J. 2008. Regional geologist, USDA Forest Service, Intermountain Region, Ogden, Utah. Personal communication with Barbara Galloway, senior hydrologist, regarding fluctuation of St. Paul Lake water levels. ERO Resources Corporation. January.

Gurrieri, J. and G. Furniss. 2004. Estimation of Groundwater Exchange in Alpine Lakes using Non-Steady Mass-Balance Methods. Journal of Hydrology Number 297. pp. 187-208.

Harestad, A.S. and D.G. Keisker. 1989. Nest tree use by primary cavity-nesting birds in south central British Columbia. Canadian Journal of Zoology 67 (4): 1067-1073.

Hargrave, P.A., A.R. English, M.D. Kerschen, G.W. Liva, J.D. Lonn, J.P. Madison, J.J. Metesh, R. Wintergerst. 1999. Abandoned-Inactive Mines of the Kootenai National Forest-Administered Land. Montana Bureau of Mines and Geology. Open File Report MBMG 395. Prepared for the USDA Forest Service Region 1.

Harms, D. 1990. Summary of Interagency biologist meeting of February 22, 1990: Grizzly bear standards and guidelines. Unpublished meeting notes. USDI Fish and Wildlife Service. Helena, MT. 20 pp.

Harris, L.D. 1984. The Fragmented Forest: Island Biogeography Theory and the Preservation of Biotic Diversity. University of Chicago Press, Chicago, IL. pp. 234.

Harris, R.B. 1984. Harvest age structure as an indicator of grizzly bear population status. M.S. thesis, University of Montana, Missoula, MT. 204 pp.

Harrison, J.E. 1972. Precambrian Belt Basin of Northwestern United States: Its Geometry, Sedimentation, and Copper Occurrence. Geological Society of America Bulletin, v. 83. pp. 1215-1240.

Harrison, J.E., E.R. Cressman, and J.W. Wipple. 1983. Preliminary Geology and Structure Map of Part of the Kalispell Two Degree Quadrangle, Montana: U.S. Geological Survey, Open-File Report 83-502.

Hash, H. 1987. Wolverine. *In* Novak, M., J. Baker, M. Obbard, and B. Malloch (eds.). No date. Wild furbearer management and conservation in North America. Ontario Trappers Association, North Bay.

Hayes, T.S. 1983. Geologic studies on the genesis of the Spar Lake stratabound copper-silver deposit, Lincoln County, Montana. Ph.d. dissertation, Stanford University. November. pp. 340.

Hayes, T.S. 1995. Letter to R. Miller, DEQ, Response to questions concerning similarities and potential differences between Rock Creek and Troy Revett-style stratabound Copper deposits. On file with the KNF and DEQ.

Hayes, T.S. and M.T. Einaudi. 1986. Genesis of the Spar Lake Strata-Bound Copper-Silver Deposit, Montana: part I. Controls Inherited from Sedimentation and Preore Diagenesis. Economic Geology, 81:1899-1931.

Hayes, T.S. and M.T. Einaudi. 1990. A preliminary study of thermometry and metal sources of the Spar Lake strata-bound copper-silver deposit, Belt Supergroup, Montana. USGS Open File Report 90-0484.

Hayward, G.D. and J. Verner (tech. eds.). 1994. Flammulated, western, and great gray owls in the United States: A technical conservation assessment. General Technical Report RM-253. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 214 pp. 3 maps.

HDR Engineering, Inc. 2007. Memorandum on electrical and magnetic fields and audible noise. Submitted to the KNF and the DEQ. pp. 4.

HDR Engineering, Inc. 2008. Estimate of Probable Construction Cost. Submitted to the KNF and DEQ. April.

Heinemeyer, K.S. and J.L. Jones. 1994. Fisher biology and management in the western United States: a literature review and adaptive management strategy. USDA Forest Service, Region 1. Missoula, MT. 109 pp.

Heinz, G. (tech. ed.) 1996 (unpublished). Fisher (*Martes pinnanti*). KNF. Libby, MT. 4 pp.

Hendricks, P., K.A. Jurist, D.L. Genter, and J.D. Reichel. 1995. Bat survey of the Kootenai National Forest, Montana: 1994. Report to USDA Forest Service, KNF, Libby, MT. Montana Natural Heritage Program. Helena, MT. 48 pp.

Hendricks, P., K.A. Jurist, D.L. Genter, and J.D. Reichel. 1996. Bats of the Kootenai National Forest, Montana. Report to USDA Forest Service, KNF, Libby, MT. Montana Natural Heritage Program. Helena, MT. 99 pp.

Highway Capacity Manual. 2000. Transportation Research Board, National Research Council, Washington, DC, National Academy of Sciences. Chapters 12, 17, 20, and 21.

Hillis, J.M., M.J. Thompson, J.E. Canfield, L.J. Lyon, C.L. Marcum, P.M. Dolan, and D.W. McCleery. 1991. Defining elk security: the Hillis paradigm. pp. 38-43. *In* A.G. Christensen, L.J. Lyon, and T.N. Lonner, comps., Proc. Elk Vulnerability Symp., Montana State University, Bozeman, MT. 330 pp.

Hintz, L. and L. Lockard. 2006. Upstream Fish Passage Studies Annual Progress Report - 2005, Fish Passage / Native Salmonid Program, Appendix C. Report to Avista Corporation, Spokane, Washington. U.S. Fish and Wildlife Service, Creston, NT and Avista Corporation, Noxon, MT.

Hintz, L. and L. Lockard. 2007. Upstream Fish Passage Studies Annual Progress Report - 2006, Fish Passage / Native Salmonid Program, Appendix C. Report to Avista Corporation, Spokane, Washington. U.S. Fish and Wildlife Service, Creston, MT and Avista Corporation, Noxon, MT.

Historical Research Associates, Inc. 1989a. Cultural Resource Inventory, Noranda's Montana Project, Lincoln and Sanders Counties, Montana. Prepared for Noranda Minerals Corporation. Submitted to the KNF and the DEQ. pp. 58 plus appendices.

Historical Research Associates, Inc. 1989b. Cultural Resource Inventory of the Bear Creek Road and Two Proposed Percolation Pond Sites, Lincoln County, Montana. Prepared for Noranda Minerals Corporation. Submitted to the KNF and the DEQ. pp. 7.

Historical Research Associates, Inc. 1989c. Cultural Resource Data Review of Noranda's Proposed Transmission Line, Lincoln County, Montana. Prepared for Noranda Minerals Corporation. Submitted to the KNF and the DEQ. pp. 15.

Historical Research Associates, Inc. 1990. Cultural Resource Reconnaissance of Noranda's Montanore Powerline Corridors and Related Features, Lincoln County, Montana. Prepared for Noranda Minerals Corporation. Submitted to the KNF and the DEQ. pp. 13.

Historical Research Associates, Inc. 2006a. Draft Report, Archaeological survey of portions of the proposed Montanore Project, Kootenai National Forest, Lincoln County, MT. Submitted to the KNF and the DEQ. pp. 39 plus appendices.

Historical Research Associates, Inc. 2006b. Draft Report, Archaeological survey of the proposed transmission line associated with the Montanore Project, Kootenai National Forest, Lincoln County, MT. Submitted to the KNF and the DEQ. pp. 30 plus appendices.

Hoffman, G., B. Marotz, J. DeShazer, T. Ostrowski, and J. Dunnigan. 2002. Mitigation for the Construction and Operation of Libby Dam. Project Number 1995-00400. Bonneville Power Administration Report DOE/BP-00006294-1. pp. 163.

Holdeman Landscape Architecture, LLC. 2006. Visual analysis methods. Submitted to the KNF and the DEQ. pp. 3.

Horn C., and T. Tholl. 2008 Native salmonid abundance and tributary habitat restoration monitoring, including summarized data, 1999-2007, Appendix B. Report to Avista Corporation, Spokane, WA. Montana Fish, Wildlife and Parks, Thompson Falls, and Avista Corp., Noxon, MT.

Hortness, J.E. 2006. Estimating low-flow frequency statistics for unregulated streams in Idaho. U.S. Geological Survey Scientific Investigations Report 2006-5035. pp. 15 plus appendices.

Huntingdon Chen-Northern, Inc. 1994. 1993 Water resources monitoring program, summary report, March 1993 through October 1993. Submitted to the Montana Department of State Lands.

Huntingdon Engineering & Environmental, Inc. 1995. 1994 Water resources monitoring program, summary report, January 1994 through December 1994. Submitted to the Montana Department of State Lands.

Hutto, R.L. 1995. The composition of bird communities following stand-replacement fires in northern Rocky Mountain conifer forests. Conservation Biology 9:1041-1058.

HydroQual, Inc. 2008. Calculation of BLM Fixed Monitoring Benchmarks for Copper at Selected Monitoring Sites in Colorado. Final Report. GLEC.030.004.01.001. Report prepared for the U.S. Environmental Protection Agency.

Idaho Department of Fish and Game. 2004. White-tailed deer management plan 2005-2014. Boise, ID. 62 pp.

Interagency Grizzly Bear Committee (IGBC). 1998. Interagency Grizzly Bear Committee – Taskforce report: Selkirk/Cabinet-Yaak Grizzly Bear Recovery Areas, interim access management rule set. 8 pp.

Interagency Grizzly Bear Committee (IGBC). 1990. CEM – A model for assessing effects on grizzly bears. USDA Forest Service, U.S. Fish and Wildlife Service, BLM, Idaho Department of Fish and Game, Montana Fish, Wildlife, and Parks, Wyoming Fish and Game, National Park Service, Washington Department of Wildlife. Missoula, MT. 24 pp.

Interagency Grizzly Bear Committee. 2004. Identifying and managing wildlife linkage approach areas on public lands. IGBC Public Lands Wildlife Linkage Taskforce. June 17. 35 pp.

IRIS. 2005. Available at: <www.epa.gov/iris/>.

Jackman, S.M. 1974. Woodpeckers of the Pacific Northwest: their characteristics and their role in the forests. M.S. thesis, Oregon State University, Corvallis, OR.

Jambor, J.L., D.W. Blowes, and C.J. Ptacek. 2000. Mineralogy of mine wastes and strategies for remediation. European Mineralogical Union Notes in Mineralogy, Volume 2 (2000), Chapter 7. pp. 260.

Japser Geographics. 2005. Technical report on asbestos sampling of the Montanore Project. Submitted to the KNF and the DEQ. pp. 4 plus appendices.

Jepson, Wayne. 2008. Hydrologist, DEQ. Email communication with Barbara Galloway, Hydrologist, ERO Resources Corporation. DEQ Project Record, Montanore Project. November 17.

Jeresek, J. 2006a. Recreation Specialist, KNF. Personal communication with Julia Grant, Natural Resource Specialist, ERO Resources Corporation. KNF, Project Record, Montanore Project. January 23.

Jeresek, J. 2006b. Recreation Specialist, KNF. Personal communication with Julia Grant, Natural Resource Specialist, ERO Resources Corporation. KNF Project Record, Montanore Project. September 28.

Johns, W.M. 1970. Geology and mineral deposits of Lincoln and Flathead counties, Montana. Montana Bureau of Mines and Geology Bulletin 79.

Johnson, W.J. 1999 (unpublished). Sensitive Species Status Summary: KNF. USDA Forest Service. Libby, MT. 36 pp.

Johnson, W.J. 2003 (unpublished). Incidental Take Analysis for Grizzly Bears that occur outside Recovery Zones on the Kootenai and Idaho Panhandle National Forests and a portion of the Lolo National Forest. USDA Forest Service, Kootenai NF. Libby, MT. 32 pp.

Johnson, W.J. (editor). 2004a (unpublished). A Conservation Plan Based on the 1987 KNF Land Management Plan as Amended. KNF Wildlife-Fish-Botany (WFB) Steering Group KNF. Libby, MT. 17 pp. plus appendices.

Johnson, W.J. (editor). 2004b (unpublished). Wolverine and Fisher Hierarchical Approach to Conservation on the KNF. USDA Forest Service, KNF Wildlife-Fish-Botany (WFB) Steering Group Kootenai NF. Libby, MT. 8 pp.

Johnson, W.J. 2007a. In defense of Wakkinen and Kasworm (1997) paper as "best science" in the Selkirk and Cabinet-Yaak Grizzly Bear Ecosystems. Unpublished Report, USDA Forest Service, KNF. Libby, MT. 8 pp

Johnson, Wayne J. 2007b. Clarification of "Grizzly bear analysis requirements in light of Judge Molloy's December 13, 2006 decision to set aside the 2002 Final EIS and 2004 ROD for the Access Amendment". Unpublished report, September 25. USDA Forest Service, KNF, Libby, MT. 2pp.

Johnson, W.J. 2007c. Rationale for grizzly bear effects analysis process following Judge Molloy's decision (12/13/2006) to set aside the "Access Amendment" EIS and ROD. Unpublished Report, September 28. USDA Forest Service, KNF. Libby, MT. 4 pp.

Johnson, W. (editor), B. Lyndaker, D. Wrobleski, W. Kasworm and W. Wakkinen. 2008. "Bear Year" Definition for the Cabinet-Yaak Ecosystem. USDA Forest Service unpublished report. Kootenai, Idaho Panhandle, and Lolo NF. Libby, MT. 2 pp.

Johnson, W. and F. Lamb. 1998 (unpublished). Forest Plan Monitoring: Snags. USDA Forest Service, KNF. Libby, MT. 4 pp.

Jomini, P.P. 2006a. Safety Management Engineer, Montana Department of Transportation. Letter to Gary Strike, Senior Engineer, Ogden Engineering & Consulting. March 24.

Jomini, P.P. 2006b. Safety Management Engineer, Montana Department of Transportation. Letter to Gary Strike, Senior Engineer, Ogden Engineering & Consulting.

Jones, J.L. and E.O. Garton. 1994. Selection of successional stages by fishers in northcentral Idaho. *In* Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski. (tech. eds.). 1994. The Scientific Basis for Conserving Forest Carnivores American Marten, Fisher, Lynx and Wolverine in the Western United States. General Technical Report RM-254. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO. 184 pp.

Joslin, G. 1980. Mountain Goat Habitat Management Plan for the Cabinet Mountains, Montana. Montana Fish, Wildlife, and Parks, Helena, MT. 122 pp.

Joslin, G. and H. Youmans (coordinators). 1999. Effects of recreation on Rocky Mountain wildlife: A review for Montana. Committee on effects of recreation on wildlife, Montana Chapter of the Wildlife Society. 307 pp.

Justice, Ken. 2008. Pilot, Kalispell Regional Medical Center, ALERT Air Ambulance. Personal communication with Bill Mangle, Natural Resource Planner, ERO Resources Corporation. January 18.

Kasworm, W. 2008. Grizzly Bear Update for the Selkirk/Cabinet-Yaak Interagency Grizzly Bear Committee. Internal Forest Service memorandum, November 6. On file with the KNF.

Kasworm, W. and S. Knick. 1989. Shooting mortality in small populations of grizzly bears. Wildlife Society Bulletin 17:11-15.

Kasworm, W. and T. Manley. 1988. Grizzly bear and black bear ecology in the Cabinet Mountains of northwest Montana. Montana Fish, Wildlife, and Parks. Helena, MT. 122 pp.

Kasworm, W. and T. Their. 1990. Cabinet-Yaak Ecosystem Grizzly Bear and Black Bear Research Progress Report. USDI Fish and Wildlife Service. Missoula, MT. 53 pp.

Kasworm, W.F., H. Carriles, T.G. Radandt, and C. Servheen. 2005. Cabinet-Yaak Grizzly Bear Recovery Area 2004 Research and Monitoring Progress Report. USDI Fish and Wildlife Service, University of Montana. Missoula, MT. 69 pp.

Kasworm, W.F., H. Carriles, T.G. Radandt, and C. Servheen. 2007. Cabinet-Yaak Grizzly Bear Recovery Area 2006 Research and Monitoring Progress Report. USDI Fish and Wildlife Service. Missoula, MT. 69 pp.

Katzman, L., and L. Hintz. 2003. Bull River Westslope Cutthroat Trout and Bull Trout Life History Study, Final Report-2000. Fish Passage/Native Salmonid Restoration Plan, Appendix C, and Montana Tributary Habitat Acquisition and Recreational Fisher Enhancement Program, Appendix B. Report to Avista Corporation, Spokane, WA. Montana Fish, Wildlife and Parks, Thompson Falls, and Avista Corp., Noxon, MT.

Kimbell, A.R. 2004. Northern Region revised sensitive species list. 2670 letter, USDA Forest Service Region 1. Missoula, MT. 10 pp.

Kimbell, A.R. 2005. Addition of the goshawk and black-backed woodpecker to the R1 sensitive species list. 2670 letter March 31. USDA Forest Service, Region 1. Missoula, MT. 1p.

Klemm, D.J., P.P.A. Lewis, F. Fulk, and J.M. Lazorchak. 1990. Macroinvertebrate Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters. EPA/600/4-90/030. Office of Water, Washington, DC.

Klepfer Mining Service LLC. 2008a. Montanore Project - Permit 150 – Revisions. Letter to Warren McCullough, DEQ. pp.2.

Klepfer Mining Service LLC. 2008b. Petition to amend the Montanore Project Hard Rock Mining Impact Plan. Letter to Joe LaForest, Montana Hard Rock Mining Impact Board. pp. 2.

Kline Environmental Research, LLC, ADC Services, Inc., and Watershed Consulting, LLC. 2005. Montanore Project: Fish passage status of culverts. Submitted to the KNF and the DEQ. pp. 8 plus appendices.

Kline Environmental Research, LLC, and Watershed Consulting, LLC. 2005a. Montanore Project: Stream fish surveys, Year 2005. Submitted to the KNF and the DEQ. pp. 7.

Kline Environmental Research, LLC, and Watershed Consulting, LLC. 2005b. Montanore Project: Spawning gravel composition, Year 2005. Submitted to the KNF and the DEQ. pp. 10 plus appendices.

Kline Environmental Research, LLC. 2004. Summary and update of stream biology and habitat information for the Montanore Project. Submitted to the KNF and the DEQ. pp. 35 plus appendices.

Kline Environmental Research, LLC. 2005a. Montanore Project: Fish habitat potential in the Little Cherry Creek tailings impoundment diversion. Submitted to the KNF and the DEQ. pp. 20 plus appendices.

Kline Environmental Research, LLC. 2005b. Montanore Project: Permanent, natural barriers to upstream movement of fish. Submitted to the KNF and the DEQ. pp. 20.

Klohn Crippen Berger Ltd. 2007. Montanore tailings facility, updated design aspects. Prepared for Mines Management, Inc. Submitted to the KNF and the DEQ. pp. 49.

Klohn Crippen Berger Ltd. 2008. Montanore tailings storage facility: requirements for consideration of artesian pressures. Prepared for Mines Management, Inc. Submitted to the KNF and the DEQ. pp. 2.

Klohn Crippen Consultants Ltd. 2005. Draft Tailings Technical Design Report. Submitted to the KNF and the DEQ. pp. 149 plus appendices.

KNF Lynx Taskforce. 1997. Lynx Conservation Strategy KNF. USDA Forest Service Libby, MT. 6 pp. plus appendices.

Knight, R.L. and S.K. Knight. 1984. Responses of wintering bald eagles to boating activity. Journal of Wildlife Management 51(2):415-420.

Knight-Piesold and Co. 2007. Genesis Inc. Troy Mine, Report on Phase 2 Program on Stability Analyses, Capacity Review and Recommendations for Ongoing Raises. Submitted to the KNF and the DEQ. p. 15.

Kocis, S.M., D.B.K. English, S.J. Zarnoch, R. Arnold, and L. Warren. 2003. National Visitor Use Monitoring Results-KNF. USDA Forest Service, Region 1. pp. 23.

Kolbe, J.A., J.R. Squires, D.H. Pletscher, and L.F. Ruggiero. 2007. The Effect of Snowmobile Trails on Coyote Movements Within Lynx Home Ranges. Journal of Wildlife Management 71(5):1409 – 1418.

Kootenai National Forest and Montana Department of Environmental Quality. 2006. Montanore Project: Scoping content analysis report. pp. 25 plus appendix.

Kootenai National Forest. 1986. Cabinet Mountains Mineral Activity Coordination Report. pp. 68 plus appendices.

Kootenai National Forest. 1993. Conservation Assessment *Thelypteris phegopteris*. Unpublished report of KNF. Libby, MT.

Kootenai National Forest. 2002. Kootenai National Forest Heritage Guidelines: Site Survey Strategy. On file with the KNF.

Kootenai National Forest. 2005. Roads Analysis Report. On file with the KNF.

Kootenai National Forest. 2007a. Kootenai National Forest Invasive Plant Management Final EIS, Appendix A. pp. 14.

Kootenai National Forest. 2007b. KNF Equivalent Clearcut Acres (ECA) Calculator. pp. 8.

Kootenai National Forest. 2007c. Biological Assessment for bull trout (*Salvelinus confluentus*) and white sturgeon (*Acipenser transmontanus*), Mytee Fine Placer Suction Dredging and Trenching, Libby Creek. pp 22. On file with the KNF.

Kootenai National Forest. 2008. KNF Noxious Weed Handbook, Spring 2008, Edition 5.0. On file with the KNF.

Kootenai Tribe of Idaho and Montana Fish, Wildlife and Parks (FWP). 2004. Kootenai Subbasin Plan. Part 1: Kootenai River Subbasin Assessment. Prepared for the Northwest Power and Conservation Council. Portland, OR.

Kunz, T.H., and R.A. Martin. 1982. *Plecotis townsendii*. Mammalian Species. No. 175. pp. 1-6.

Lange, I.M. and R.A. Sherry. 1983. Genesis of the sandstone (Revett) type of copper-silver occurrences in the Belt Supergroup of NW Montana and NE Idaho. Geology. pp. 643-646.

Laudon, K. 2008. Wolf Management Specialist, Montana Fish, Wildlife, and Parks. Personal communication with K. Baud, Wildlife Biologist, ERO Resources Corporation. September 18 and October 5.

Leary, R. 2003. Memorandum to Mike Hensler, Montana Fish, Wildlife, and Parks regarding results of genetic analysis of trout. May 1.

Leary, R. 2006. Memorandum to Mike Hensler, Montana Fish, Wildlife, and Parks regarding results of genetic analyses of trout from Little Cherry Creek. January 16.

Leirfallom, J. 1970. Wolf management in Minnesota. *in*: Jorgensen, S.E., L.E. Faulkner, and L.D. Mech (eds.). Proceeding symposium on wolf management in selected areas of North America. USDI Fish and Wildlife Service. 50 pp. *In* Frederick, G. P. 1991. Effects of Forest Roads on Grizzly Bears, Elk, and Gray Wolves: A Literature Review. USDA Forest Service, KNF, 506 U.S. 2 West. Libby, MT. 53 pp.

Lenat, D.R. and D.L. Penrose. 1996. History of EPT taxa richness metric. Bulletin of the North American Benthological Society 13:305-307.

Liermann, B.W. and T. D. Tholl. 2003. Bull River and Elk Creek temperature and sediment investigations final report-2002, Montana Tributary Habitat Acquisition and Recreational Fisher Enhancement Program, Appendix B. Report to Avista Corporation, Spokane, WA. Montana Fish, Wildlife and Parks, Thompson Falls, and Avista Corp., Noxon, MT.

Lincoln County 2004. Lincoln County, Montana. Integrated Noxious Weed Management Plan. Available at: <http://www.lincolncountymt.us/County%20Weed%20plan%2004.pdf>.

Linkhart, B.D. 2001. Life history characteristics and habitat quality of flammulated owls (*Otus flammeolus*) in Colorado. Ph. D. Dissertation. University of Colorado, Boulder, CO. 221 pp.

Linkhart, B.D. and R.T. Reynolds. 1997. Territories of flammulated owls (*Otus flammeolus*): is occupancy a measure of habitat quality? Pages 250-254 in J.R. Duncan, D.H. Johnson, and T.H. Nicholls, editors. Biology and Conservation of owls in the Northern Hemisphere. USDA Forest Service General Technical Report NC-190.

Linkhart, B.D., R.T. Reynolds, and R.A. Ryder. 1998. Home range and habitat of breeding flammulated owls in Colorado. Wilson Bull. 110(3):342-351.

Lockard, L., R. Weltz, J. Stover, E. Stender, J. Storaasli. 2003. Downstream Juvenile Bull Trout Transport Program Annual Progress Report - 2002, Fish Passage/Native Salmonid Program. Appendix C. Report to Avista Corporation, Spokane, Washington. U.S. Fish and Wildlife Service, Creston, MT and Avista Corporation, Noxon, MT.

Lockard, L., L. Hintz, S. Wilkinson, and S. Skaggs. 2004a. Experimental Adult Fish Passage Studies Annual Progress Report - 2003, Fish Passage / Native Salmonid Program, Appendix C. Report to Avista Corporation, Spokane, Washington. U.S. Fish and Wildlife Service, Creston, MT and Avista Corporation, Noxon, MT.

Lockard, L., R. Weltz, J. Stover, E. Stender, J. Storaasli. 2004a. Downstream Juvenile Bull Trout Transport Program Annual Progress Report - 2003, Fish Passage / Native Salmonid Program. Appendix C. Report to Avista Corporation, Spokane, Washington. U.S. Fish and Wildlife Service, Creston, MT and Avista Corporation, Noxon, MT.

Lockard, L. and L. Hintz. 2005. Upstream Fish Passage Studies Annual Progress Report - 2004, Fish Passage / Native Salmonid Program, Appendix C. Report to Avista Corporation, Spokane, Washington. U.S. Fish and Wildlife Service, Creston, MT and Avista Corporation, Noxon, MT.

Lockard, L., R. Weltz, and E. Stender-Wormwood. 2005. Tributary Trapping and Downstream Juvenile Bull Trout Transport Program Annual Progress Report - 2004, Fish Passage / Native Salmonid Restoration Program. Appendix C. Report to Avista Corporation, Spokane, Washington. U.S. Fish and Wildlife Service, Creston, MT and Avista Corporation, Noxon, MT.

Lockard, L., R.Weltz, J. Stover, and S. Skaggs. 2008. Tributary Trapping and Downstream Juvenile Bull Trout Transport Program Annual Progress Report - 2007, Fish Passage/ Native Salmonid Restoration Program. Appendix C. Report to Avista Corporation, Spokane, Washington. U.S. Fish and Wildlife Service, Creston, MT and Avista Corporation, Noxon, MT.

Logan. R. 2001. Water Quality BMPs Best Management Practices For Montana Forests. MSU Extension Service EB 158, pp. 58.

Lydy, M.J., C.G. Crawford, and J.W. Frey. 2000. A comparison of selected diversity, similarity, and biotic indices for detecting changes in benthic-invertebrate community structure and stream quality. Archives of Environmental Contamination and Toxicology 39:469-479.

Lyon, L.J. 1966. Problems of habitat management for deer and elk in the northern forests. Research Paper INT-24. USDA Forest Service, Intermountain Forest and Range Research Station. Ogden, UT. 15 pp.

Lyon, L.J. 1979. Habitat effectiveness for elk as influenced by roads and cover. Journal For. 77:658-660.

Lyon, L. J. 1984. Field tests of elk/timber coordination guidelines. Research paper INT – 325. USDA Forest Service, Intermountain Forest and Range Research Station. Ogden, UT. 10 pp.

Lyon, L.J., T.N. Lonner, J.P. Weigand, C.L. Marcum, W.D. Edge, J.D. Jones., D.W. McCleery, and L.L. Hicks. 1985. Coordinating elk and timber management, final report of the Montana cooperative elk-logging study 1970-1985. Montana Fish, Wildlife and Parks. Helena, MT. 53 pp.

Mackie, R.J., D.F. Pac, K.L. Hamlin, and G.L. Dusek. 1998. Ecology and Management of Mule Deer and White-tailed Deer in Montana. Montana Fish, Wildlife and Parks. Helena, MT. 180 pp.

Mahar, J.W. and G.G. Marino. 1981. Building Response and Mitigation Measures for Building Damages in Illinois. Proceedings, Workshop on Surface Subsidence due to Underground Mining. Morgantown, WV. pp. 238–252.

Mallonnee, J. 2006. Research Biologist. Wolf and Wildlife Studies. Personal communication with Al Bratkovich, Wildlife Biologist, KNF. June, KNF Project Record, Montanore Project.

Mannan, R.W. 1977. Use of snags by birds, Douglas-fir region, western Oregon. M.S. thesis, Oregon State University, Corvallis, OR.

Mannan, R.W., E.C. Meslow, and H.M. Wight. 1980. Use of snags by birds in Douglas-fir forests, western Oregon. Journal of Wildlife Management 44:787-97.

Martell, M. 1992. Bald Eagle Winter management guidelines. USDI Fish and Wildlife Service, Region 3. Minneapolis, MN.

Maxell, B.A. 2000. Management of Montana's Amphibians: A Review of Factors that may present a Risk to Population Viability and Accounts on the Identification, Distribution, Taxonomy, Habitat Use, Natural History and the Status and Conservation of Individual Species. A Report (#43-0343-0-0224) to Northern Regional Office, USDA Forest Service. Missoula, MT 59807. 161 pp.

Maxell, B.A., J.K. Werner, P. Hendricks, and D. Flath. 2003. Herpetology in Montana: A history, status summary, checklists, dichotomous keys, accounts for native, potentially native and exotic species, and indexed bibliography. Northwest Fauna 5. Society for Northwestern Vertebrate Biology. Olympia, WA. 138 pp.

Maxim Technologies, Inc. 1996. 1995 Water resources monitoring program, summary report, January through December 1995. Submitted to the Montana Department of Environmental Quality.

Maxim Technologies, Inc. 1997. 1996 Water resources monitoring program, summary report. Submitted to the Montana Department of Environmental Quality.

Maxim Technologies, Inc. 1998. 1997 Water resources monitoring program, summary report. Submitted to the Montana Department of Environmental Quality.

Maxim Technologies, Inc. 2003. Rock Creek Project: 2003 Geochemistry Review. Report prepared for KNF.

Maxim Technologies, Inc. 2004. Draft Engineering Evaluation Cost Analysis: Snowshoe Mine, Snowshoe Creek, and Big Cherry Millsite. May.

Maxim Technologies, Inc. 2005. Visual resources baseline study, Montanore Project. Submitted to the KNF and the DEQ. p. 9.

McAllister, K. 2007. Project Analysis in Region 1: Northern Goshawk guidance, black-backed woodpecker guidance and removal of the northern goshawk from the sensitive species list. USDA FS 1380-3 letter of July 17, 2007. Northern Region, Missoula, MT. 2pp

McCarigal, K., R.G. Anthony, and F.B. Isaacs. 1991. Interactions of humans and bald eagles on the Columbia River estuary. Wildlife Monographs #115.

McClelland, B.R. 1977. Relationship between hole-nesting birds, forest snags, and decay in western larch-Douglas-fir forests of the northern Rocky Mountains. Ph.D. dissertation, University of Montana. Missoula, MT. 495 pp.

McClelland, B.R. 1979. The pileated woodpecker in forests of the northern Rocky Mountains, pp. 283-299 *in* The role of insectivorous birds in forest ecosystems, Dickson, James G., R.N. Conner, R.R. Fleet, J.C. Kroll, and J.A. Jackson, [editors]. Academic Press, New York, NY.

McClelland, B.R., and P.T. McClelland. 1999. Pileated woodpecker nest and roost trees in Montana: links with old-growth and forest health. Wildlife Society Bulletin 27 (3): 846-857.

McClelland, B.R., S.S. Frissell, W.C. Fisher, and C.H. Halvorson. 1979. Habitat management for hole-nesting birds in forests of western larch and Douglas-fir. Journal of Forestry 77 (8): 480-483.

McGrath, M.T., S. DeStefano, R.A. Riggs, L.L. Irwin, and G.J. Roloff. 2003. Spatially explicit influences on northern goshawk nesting habitat in the interior Pacific Northwest. Wildlife Monographs No. 154, 63 pp.

McKay, J. 2007. Senior Geologist. KNF. Personal communication with Michael Galloway, senior hydrogeologist. ERO Resources Corporation. October.

McKelvey, K.S., Y.K. Ortega, G.M. Koehler, K.B. Aubry, and J.D. Brittell. 2000. Canada lynx habitat and topographic use patterns in north central Washington: a reanalysis. Pages 307-336. *In* Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey, and J.R. Squires (tech. eds.). Ecology and conservation of lynx in the United States. University Press of Colorado. Boulder, CO. 480 pp.

McLeod, H. and Plewes, H. 1999. Risk Management Analysis, Canadian Dam Safety Conference, Sudbury, Canada. p. 10

McMaster, K. 1995. Amended Biological Opinion on Kootenai Forest Plan to include an Incidental Take Statement. Letter to R. Schrenk, Forest Supervisor. USDI Fish and Wildlife Service. Helena, MT. July 27. 15 pp.

Mellen, T.K. 1987. Home range and habitat use of pileated woodpeckers, western Oregon. M.S. thesis, Oregon State University, Corvallis, OR.

Mellen, T.K., E.C. Meslow, and R.W. Mannan. 1992. Summertime home range and habitat use of pileated woodpeckers in western Oregon. Journal of Wildlife Management 56 (1): 96-103.

Mine Development Associates. 2003. Draft, Mineralization on the Montanore Project, Sanders County, Montana. Report for Mines Management Corporation. *In* Geomatrix Consultants, Inc. 2006a. Water resources report for CMW Area, Montanore Mine Project. Submitted to the KNF and the DEQ. p. 37 plus appendices.

Mine Safety and Health Administration. 1999. Haul road inspection handbook. Handbook Number PH99-I-4. p. 76.

Mines Management, Inc. 2005a. Revised application/re-authorization, hard rock operating permit and proposed plan of operations, Montanore Project, Lincoln and Sanders Counties, Montana. Submitted to the KNF and the DEQ. p. 425 plus appendices.

Mines Management, Inc. 2005b. Application for a 230-kV transmission line, Montanore Project, Lincoln County, Montana. Submitted to the KNF and the DEQ. p. 108 plus appendices.

Mines Management, Inc. 2006. Ecological Assessment and Best Management Practices for the Montanore Mine Facilities in Regard to INFISH Standards and Guidelines (Draft). Submitted to the KNF and the DEQ. p. 16 plus appendices.

Mitchell, M. C. and A. Bratkovich. 1993. Bird abundance in old growth forest fragments and harvested stands in the Kootenai National Forest (unpublished). KNF. Libby, MT. 24 pp.

Montana Bald Eagle Working Group (MBEWG). 1991. Habitat management guide for bald eagles in northwestern Montana. USDA Forest Service. Missoula, MT. 29 pp.

Montana Bald Eagle Working Group (MBEWG). 1994. Montana bald eagle management plan. Department of the Interior, Bureau of Land Management. Billings, MT. 61 pp.

Montana Bull Trout Restoration Team. 2000. Restoration plan for bull trout in the Clark Fork River Basin and Kootenai River Basin Montana. Prepared for Governor Marc Racicot. Helena, MT.

Montana Bull Trout Scientific Group. 1996. Lower Clark Fork River Drainage Bull Trout Status Report (Cabinet Gorge Dam to Thompson Falls). Prepared for the Montana Bull Trout Restoration Team. Helena, MT.

Montana Bull Trout Scientific Group. 1998. The relationship between land management activities and habitat requirements for bull trout. Prepared for the Montana Bull Trout Restoration Team. Helena, MT.

Montana Fish, Wildlife and Parks (FWP). 2004a. Statewide elk management plan for Montana. Wildlife Division. Helena, MT. 394 pp.

Montana Fish, Wildlife and Parks (FWP). 2004b. Region One Elk Annual Report. Prepared by Bruce Sterling. July 2003 to June 2004.

Montana Fish, Wildlife and Parks (FWP). 2004c. Region One White-tailed Deer Progress Report. Prepared by Tom Litchfield. 67 pp.

Montana Fish, Wildlife and Parks (FWP). 2005. Now You Know: A collection of facts and figures about Montana Fish, Wildlife, and Parks. pp. 57.

Montana Fish, Wildlife and Parks (FWP). 2007a. Region One Elk Annual Report, July 2004–June 2007. Prepared by B. Sterling.

Montana Fish, Wildlife and Parks (FWP). 2007b. Moose Management in Northwest Montana, Region One Annual Report, July 1, 2006 – June 30, 2007. Prepared by J. Brown.

Montana Fish, Wildlife and Parks (FWP). 2007c. Moose Management in Northwest Montana, Region One Annual Report, July 1, 2006 – June 30, 2007. Prepared by J. Brown.

Montana Fish, Wildlife and Parks (FWP). 2008a. Montana Fisheries Information System. Available at: <http://fwp.mt.gov/fishing/mfish/>.

Montana Fish, Wildlife and Parks (FWP). 2008b. Region One White-tailed Deer Report. Prepared by John Vore. 23 pp.

Montana Fish, Wildlife and Parks (FWP). 2008c. Region One White-tailed Deer Report. Prepared by John Vore. 23 pp.

Montana Fish, Wildlife and Parks (FWP). 2008d. Montana Statewide Angling Pressure–2007. p. 173.

Montana Fish, Wildlife and Parks (FWP). 2009. FWP Goals and Objectives. Available at: <http://fwp.mt.gov/doingBusiness/insideFwp/aboutUs.html>.

Montana Fish, Wildlife and Parks (FWP) and Montana Natural Heritage Program (MNHP). 2006. Montana Animal Species of Concern. Available at: <http://fwp.mt.gov/wildthings/concern/default.html>.

Montana Fish, Wildlife and Parks (FWP) and Montana Natural Heritage Program (MNHP). 2007. Animal Field Guide. Available at: <http://fwp.mt.gov/fieldguide/detail_AMALC03010.aspx>.

Montana Department of Transportation. 2006. Traffic Data Collection Section. E-mails to Gary Strike, Senior Engineer, Ogden Engineering & Consulting.

Montana Department of Transportation. 2000. Montana Road Design Manual, Chapter 13, Intersections at Grade.

Montana Natural Heritage Program (MNHP). 1993. *Plecotus townsendii*, Townsend's big-eared bat. Vertebrate Characterization Abstract. 5 pp.

Montana Natural Heritage Program (MNHP). 2005. Plant and animal species of special concern near the Montanore Project. Element occurrence records provided by Montana Natural Heritage Program. Helena, MT.

Montana Natural Heritage Program (MNHP). 2006a. Plant Species of Concern. Available at: <http://mtnhp.org/plants/plist_bkgrd.asp>.

Montana Natural Heritage Program (MNHP). 2006b. Survey of historical northern goshawk nesting territories on the Kootenai National Forest: progress report. Helena, MT. 9 pp.

Montana Natural Heritage Program (MNHP). 2008. Species of concern reports found at: <http://nhp.nris.mt.gov/SpeciesOfConcern/>.

Montana/Northern Idaho Level I Team. 2006. Guide to Effects Analysis of Helicopter Use in Grizzly Bear Habitat. December. 6 pp.

Montana Summit Steering Committee Weed Management Task Force. 2005. The Montana Weed Management Plan. Available at: <http://agr.mt.gov/weedpest/pdf/2005weedPlan.pdf>.

Montanore Minerals Corp. 2006. Notification to resume suspended exploration and drilling activities for the Montanore Project. Submitted to the KNF and the DEQ. p. 20 plus appendices.

Montanore Minerals Corp. 2008. Updated Plan of Operations. Submitted to the KNF. pp. 220 plus appendices.

Moran, S. and J. Storaasli. 2008. Non-native Fish Suppression project in the East Fork Bull River, Montana. Annual Progress Report - 2007. Fish Passage/Native Salmonid Program Appendix C. Prepared for Avista Corporation, Noxon, MT.

Morgan, J.T. 1993. Summer habitat use of white-tailed deer on the Talley Lake Ranger District, Flathead National Forest. Ph.D. Thesis, Montana State University, Bozeman, MT. 103 pp.

Morrison, M.L., B.G. Marcot, R.W. Mannan. 1992. Wildlife-Habitat Relationships: Concepts and Applications. The University of Wisconsin Press. Madison, WI. p. 337.

Morrison-Knudsen Engineers, Inc. 1988. Montana Silver Venture, Alternative sites reconnaissance. Submitted to the KNF and the DSL. p. 9 plus figures and appendices.

Morrison-Knudsen Engineers, Inc. 1989a. Montana Project, Geotechnical report. Submitted to the KNF and the DSL. p. 46 plus figures and appendices.

Morrison-Knudsen Engineers, Inc. 1989b. Montana Project, Geotechnical site evaluation report. Submitted to the KNF and the DSL. p. 33 plus figures and appendices.

Morrison-Knudsen Engineers, Inc. 1990. Montanore Project, Addendum to geotechnical site report. Submitted to the KNF and the DSL. *In* Amended application for a hard rock operating permit and amended plan of operations. Mines Management, Inc. 2005. Appendix N-2. p. 27 plus figures and appendices.

Mundinger, J.G. 1981. Impacts of timber harvest on white-tailed deer in the coniferous forests of northwestern Montana. Montana Fish, Wildlife, and Parks, Kalispell, MT. NW Wildlife Society Meeting, April. 15 pp.

Murie, O.J. 1979. The elk of North America. Teton Bookshop. Jackson, WY. 376 pp.

Nanus, Leora, Donald H. Campbell, George P. Ingersoll, David W. Clow, and M. Alisa Mast. 2003. Atmospheric deposition maps for the Rocky Mountains. Atmospheric Environment 37. pp. 12.

National Atmospheric Deposition Program. 2008. NAPP/NTN Monitoring Location MT05 (Glacier National Park-Fire Weather Station). Statistical Summary of Precipitation Chemistry.

NatureServe. 2007. NatureServe Explorer, An Online Encyclopedia of Life. Available at: <www.natureserve.org/explorer/servlet>. Last updated October 6, 2007.

Neesvig, C. 2006. Hydrologist. KNF. Personal communication with Barbara Galloway, senior hydrologist regarding surface water data. ERO Resources Corporation. July.

New Jersey Department of Environmental Protection. 2007. Technical Guidance for Sizing and Positioning of Spray Irrigation Systems, Overland Flow Systems, Infiltration/Percolation Lagoon Systems, and Surface Impoundments. p. 28.

Noranda Minerals Corp. 1989. Summary of project alternatives. Submitted to the KNF and the DSL. p. 12 plus figure.

O'Connor, T. and M. Hillis. 2001 (unpublished report). Conservation of Post-fire habitat, black-backed woodpeckers and other woodpecker species on the Lolo National Forest. Lolo National Forest. Missoula, MT.

Olendorff, R.R. and N. Lehman. 1986. Raptor collisions with utility lines: an analysis using subjective field observations. Pacific Gas and Electric Co. San Ramon, CA. 73 pp.

Overton, C., K. Wollrab, B.C. Roberts, and M.A. Radko. 1997. R1/R4 (Northern/Intermountain Regions) Fish Habitat Standard Inventory Procedures Handbook. General Technical Report INT-6TR-346, USDA Forest Service, Intermountain Forest and Range Research Station, Ogden, UT.

Parametrix. 2005. Bull Trout Species Account. Prepared for Montana Department of Natural Resources and Conservation Forest Management Bureau. Bellevue, WA.

Parker, R. 2008. Senior Land Asset Manager. Plum Creek Timber Company. Personal communication with Bill Mangle, Natural Resource Planner, ERO Resources Corporation. January 24.

Paterson, A. 2006. High Concentration Hydraulic Transport Systems. *In:* Paste and Thickened Tailings – A Guide, Second Edition (Jewell and Fourie, eds.), Australian Centre for Geomechanics, Nedlands, WA, pp. 129–143.

Peng, S.S. 1992. Surface Subsidence Engineering. Society of Mining, Metallurgy, and Exploration. Littleton, CO. p. 161.

Perkins, J.M. and T. Schommer. 1991. Survey protocol and an interim species conservation strategy for *Plecotus townsendii* in the Blue Mountains of Oregon and Washington. Wallowa-Whitman National Forest, P.O. Box 907, Baker City, OR. 23 pp.

Pfister, R.D., W.L. Baker, C.E. Fiedler, and J.W. Thomas. 2000. Contract Review of Old Growth Management on School Trust Lands: Supplemental Bio-Diversity Guidance 8/02/00. Department of Natural Resources and Conservation. Helena, MT. pp. 31.

Pierson, E.D., M.C. Wachenhut, J.S. Altenbach, P. Bradley, P. Call, D.L. Genter, C.E. Harris, B.L. Keller, B. Lengus, L. Lewis, B. Luce, K.W. Navo, J.M. Perkins, S. Smith, and L. Welch. 1999. Species conservation assessment and strategy for Townsend's big-eared bat (*Corynorhinus townsendii townsendii* and *Corynorhinus townsendii pallescens*). Idaho Conservation Effort, Idaho Department of Fish and Game. Boise, ID.

Pioneer Technical Services, Inc. 2005. Draft Snowshoe Mine Site Expanded Engineering Evaluation/Cost Analysis (EEE/CA). April.

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughes. 1989. Rapid Bioassessment Protocols for Use in Streams and Rivers. EPA/444/4-89-001.

Plantenberg, P. 2006. Reclamation Specialist, DEQ. Personal communication with David Buscher, Soil Scientist/Ecological Engineer, Buscher Soil & Environmental, Inc. March 15.

Poulter, D. 2007. Poorman Creek impoundment site options. Prepared for ERO Resources Corporation. On file with the KNF and the DEQ. p. 8.

Powell, R.A. and W.J. Zielinski. 1994. Fisher. Chapter 3 *In*: Ruggiero, Leonard F., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski. (tech. eds.). 1994. The Scientific Basis for Conserving Forest Carnivores American Marten, Fisher, Lynx and Wolverine in the Western United States. General Technical Report RM-254. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO. 184 pp.

Powell, H.D. 2000. The influence of prey density on post-fire habitat use of the black-backed woodpecker. M.S. thesis, University of Montana, Missoula, MT. 99 pp.

Power Engineers, Inc. 2005a. EMF/noise analysis for the Montanore transmission line. Submitted to the KNF and the DEQ. p. 16.

Power Engineers, Inc. 2005b. Route analysis report for the Montanore transmission line. Submitted to the KNF and the DEQ. p. 28.

Power Engineers, Inc. 2005c. Technical land use report for the Montanore transmission line. Submitted to the KNF and the DEQ. p. 41 plus appendix.

Power Engineers, Inc. 2006a. Montanore transmission line project, 2005 Major Facility Siting Act application, response document to comments from the Montana Department of Environmental Quality on Montanore transmission line project. Submitted to the KNF and the DEQ. p. 194 plus appendices.

Power Engineers, Inc. 2006b. Visual resources report for the Montanore transmission line. Submitted to the KNF and the DEQ. p. 39.

Powers, L.R., A. Danle, P.A. Gaede, C. Rodes, L. Nelson, J.J. Dean, and J.D. May. 1996. Nesting and food habits of the flammulated owl (*Otus flammeolus*) in south-central Idaho. Journal of Raptor Research 30:15-20.

Price, W.A. and J.C. Errington. 1998. Guidelines for metal leaching and acid rock drainage at mine sites in British Columbia.

Price, W.A., K.A. Morin, and N.M. Hutt. 1997. Guidelines for the prediction of acid rock drainage and metal leaching for mines in British Columbia, Part II. Recommended procedures for static and kinetic testing. Proceedings of the Fourth International Conference on Acid Rock Drainage, May 31-June 6, 1997. Vancouver, BC, Canada.

Prodgers, R.A. and T.J. Keck. 1996. Vegetational diversity concepts and strategies for reclamation. *In* Planning, Rehabilitation and Treatment of Disturbed Lands. Seventh Billings Symposium. March 17-23, 1996. Montana State University Reclamation Research Unit Publication Number 9603. Bozeman, MT. pp. 141-157.

Province of British Columbia. 1995. Forest practices code guidebook: Biodiversity. Government Publication Services, Ministry of Forests, Forest Practices Branch. Victoria, BC, Canada.

Reel, S., W. Schassberger, and W. Ruediger. 1989. Caring for our natural community. Region 1. Threatened, Endangered, and Sensitive Species Program. USDA Forest Service, Region 1, Wildlife and Fisheries. 309 pp.

Reichel, J. and D. Flath. 1995. Identification guide to the amphibians and reptiles of Montana. Montana Outdoors 26(3):15-34.

Renken, R.B., W.K. Gram, D.K. Fantz, S.C. Richter, T.J. Miller, K.B. Ricke, B. Russell, and X. Wang. 2004. Effects of Forest Management on Amphibians and Reptiles in Missouri Ozark Forests. Conservation Biology 18(1)1:174-188.

Reynolds, R.T., R.T. Graham, M.H. Reiser, R.L. Bassett, P.L. Kennedy, D.A. Boyce Jr., G. Goodwin, R. Smith, and E.L. Fisher. 1992. Management Recommendations for the northern goshawk in the southwestern United States. General Technical Report. RM-217. Fort Collins, CO. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 90 pp.

Rieman, B.E. and J.D. McIntyre. 1993. Demographic and Habitat Requirements for Conservation of Bull Trout. USDA Forest Service General Technical Report INT-302.

Ripple, W.J., G.A. Bradshaw, and T.A. Spies. 1991. Measuring forest landscape patterns in the Cascade Range of Oregon, USA. Biological Conservation 57:73-88.

Robertson, A.G. and S. Shaw. 2003. Risk management for major geotechnical structures on mines. *In:* Proceedings of Computer Applications in the Mineral Industries (CAMI), Calgary, Alberta, Canada. pp. 18.

Rosgen, D. 1985. A stream classification system. *In* Riparian Ecosystems and Their Management: Reconciling Conflicting Issues. General Technical Report Number RM-120. First North American Riparian Conference. USDA Forest Service. Washington, DC.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, CO.

Ross, A. 1967. Ecological aspects of the food habits of insectivorous bats. Proc. Western Foundation of Vertebrate Zoology. 1:205-264.

Roy, K. D. 1991. Ecology of introduced fishers in the Cabinet Mountains of northwest Montana. Missoula, MT: University of Montana. M.S. thesis, 94 pp. *In* Ruggiero, Leonard F., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski. (tech. eds.) 1994. The Scientific Basis for Conserving Forest Carnivores American Marten, Fisher, Lynx and Wolverine in the Western United States. General Technical Report RM-254. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO. 184 pp.

Ruediger, B.J. Claar, S. Gniadek, B. Holt, L. Lewis, S. Mighton, B. Naney, G. Patton, T. Rinaldi, J. Trick, A. Vandehey, F. Wahl, N. Warren, D. Enger, and A. Williamson. 2000. Canada lynx conservation assessment and strategy. USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Publication #R1-00-53. Missoula, MT. pp. 142.

Ruediger, B.J. 1994 (unpublished). Wolverine, Lynx, and Fisher habitat and distribution maps, draft hierarchical approach and draft conservation strategies. USDA Forest Service 2670 letter 9/14/1994. Region 1, Missoula, MT. 5 pp. plus attachments

Ruggiero, L.F., G.D. Hayward, and J.R. Squires. 1994. Viability Analysis in Biological Evaluations: Concepts of Population Viability Analysis, Biological Population, and Ecological Scale. Conservation Biology 8(2):64-372

Ruggiero, L.F., K.B. Aubry, S.W. Buskirk [and others]. 2000. Ecology and Conservation of Lynx in the United States. University Press of Colorado. Boulder, CO. 480 pp.

Russell, W.H. and C. Jones. 2001. The effects of timber harvesting on the structure and composition of adjacent old-growth coast redwood forest, California, USA. Landscape Ecology 16:731-741.

Russell, W.H., J.R. McBride, K. Carnell. 2000. Edge effects and the effective size of old-growth coast redwood preserves. USDA Forest Service Proceedings RMRS-P-15 3:128-136.

Sage Environmental Consulting. 2007. Montanore Mine AERMOD Analyses, Multiple Alternatives. Memo from S. Connell to E. Klepfer, MMC.

Schafer and Associates. 1992. Technical Summary Report: Geochemical Kinetic Testing of Montanore Mine Waste Samples. Report prepared for Noranda Minerals Montanore Project. On file with the KNF and the DEQ.

Schafer and Associates. 1997. Final Report on Rock Creek Humidity Cell Testing. Memo report to Doug Parker, ASARCO. On file with the KNF and the DEQ.

Schippers, A., P. Jozsa, W. Sand, Z.M. Kovacs, and M. Jelea. 2000. Microbiological pyrite oxidation in a mine tailings heap and its relevance to the death of vegetation. Geomicrobiology Journal 17:151-162.

Schirato, M. 1989. Disturbance to wildlife by vehicular activity: an annotated bibliography. Washington Department of Wildlife. Olympia, WA. pp. 13.

Semlitsch, R.D. 2000. Principles for management of aquatic-breeding amphibians. Journal of Wildlife Management 64 (3):615-631.

Servheen, C., J.S. Waller, and P. Sandstrom. 2003. Identification and management of linkage zones for grizzly bears between the large blocks of public land in the northern Rocky Mountains. USDI Fish and Wildlife Service, University of Montana, Missoula, MT. 89 pp.

Shepard, B.B. 2004. Factors that may be influencing non-native brook trout invasion and their displacement of native westslope cutthroat trout in three adjacent southwestern mountain streams. North American Journal of Fisheries Management 24:1088-1100.

Shepard, B.B., K.L. Pratt, and P.J. Graham. 1984. Life Histories of Westslope Cutthroat and Bull Trout in the Upper Flathead River Basin, Montana. Sponsored by: Environmental Protection Agency through the Steering Committee for the Flathead River Basin Environmental Impact Study. Denver, CO.

Sime, C. 2002. Montana Wolf Conservation and Management Planning Document. (Draft), Prepared in response to the wolf management advisory council recommendations. Montana Fish, Wildlife and Parks, Helena, MT. Available at: <www.fwp.state.mt.us/wildthings/wolf>.

Singh, M.M. 1992. Mine Subsidence. SME Mining Engineering Handbook, Chapter 10.6, Society for Mining, Metallurgy, and Exploration. Littleton, CO.

Snow, D.T. 1968. Rock fracture spacing, openings, and porosities. American Society Civil Engineers Proceedings, Journal Soil Mechanics and Foundations. Div. 94:1. pp. 1273-1289.

Spudich, P., W.B. Joyner, A.G. Lindh, D.M. Boore, B.M. Margaris, and J.B. Fletcher. 1999. SEA99: A Revised Ground Motion Prediction Relation for Use in Extensional Tectonic Regimes, Bull. Seism. Soc. Am. 89(5):1156-1170.

Stalmaster, M.V. and J.R. Newman. 1978. Behavioral responses of wintering bald eagles to human activity. Journal of Wildlife Management 47(2):349-359.

Stantus, P. 2006a. Assistant Forest Engineer, KNF. Email to Gary Strike, Senior Engineer, Ogden Engineering & Consulting. February 21.

Stantus, P. 2006b. Assistant Forest Engineer, KNF. Personal communication with Gary Strike, Senior Engineer, Ogden Engineering & Consulting. March 1.

Storaasli, J. and S. Moran. 2008. Lower Clark Fork River, Montana, Avista Project Area. 2007 Annual Bull and brown Trout Redd Survey Report. Appendix C, Fish Passage/Native Salmonid Restoration Plan. Report to Avista Corporation, Spokane, WA. U.S. Fish and Wildlife Service, Creston, and Avista Corporation, Noxon, MT.

Story, M. 2006. Hydrologist. Gallatin National Forest. Personal communication with Barbara Galloway, senior hydrologist regarding Libby Lakes water quality. ERO Resources Corporation.

Story, M.T. 1997. ASARCO Rock Creek Mine Project Libby Lakes MAGIC/WAND Modeling, USDA Forest Service, Gallatin NF.

Stubblefield, W.A. and J.R. Hockett. 2000. Derivation of a Colorado State Manganese Table Value Standard for the Protection of Aquatic Life. ENSR Corporation. Fort Collins, CO. July.

Summerfield, R.L. 1991. Coordinating Big game and Grizzly bear standards. Internal 2600 memo, December 2, 1991. USDA Forest Service. Libby, MT. 4 pp.

Teply, M. and L. Bahls. 2005. Diatom Biocriteria for Montana Streams, 2005. Montana Department of Environmental Quality, Water Quality Monitoring Section, Helena, MT. September. pp. 22 plus appendices,

Tetra Tech, Inc. and R Squared, Inc. 2006. Final geotechnical assessment report, sinkhole development at the Troy Mine and implications for the proposed Rock Creek Mine, Lincoln and Sanders counties, MT. Prepared for the KNF. pp. 42 plus figures and appendices.

Thiel, R.P. 1978. The status of the timber wolf in Wisconsin, 1975. Wisconsin Academy of Sciences, Arts and Letters. 66:186-194.

Thiel, R.P., S. Merrill, and L.D. Mech. 1998. Tolerance by denning wolves, *Canis lupus*, to human disturbance *In:* Joslin, G. and H. Youmans, coordinators. Effects of recreation on Rocky Mountain wildlife: A Review for Montana. Committee on Effects of Recreation on Wildlife. Montana Chapter of the Wildlife Society. 307 pp.

Thomas, A. (coordinator). 1995. Forest Carnivores in Idaho: habitat conservation assessments and conservation strategies. Idaho Department of Fish and Game, Nez Perce Tribe, and Sawtooth National Forest. Boise, ID. 126 pp.

Thomas, J.W. (tech. ed.). 1979. Wildlife Habitats in Managed Forests, the Blue Mountains of Oregon and Washington. USDA Forest Service, Agricultural Handbook No. 553. Wildland Management Institute. Washington, DC.

Thomas, D.W. and S.D. West. 1991. Forage age associations of bats in the Washington Cascade and Oregon Coast Ranges. In: Wildlife and vegetation of unmanaged Douglas-fir forests. General Technical Report PNW-285. Portland, OR. pp. 295-303.

Thompson, R.J. 1989. Draft Evaluation of Alternative Disposal Sites and Disposal Methods for the ASARCO Rock Creek Project. USDA Forest Service, Kootenai National Forest. Libby, MT. pp. 35 plus appendices.

Thorburn, S. and W.M. Reid. 1977. Incipient Failure and Demolition of Two Story Dwellings due to Large Ground Movements. Large Ground Movements and Structures: Proceedings, Conference at University of Wales, Institute of Science and Technology, Cardiff, Wales, Wiley. pp. 87–99.

Tincher, D. 1998 (unpublished). Estimating Snag Levels within 200 feet of open roads on the Fortine Ranger District. USDA Forest Service, KNF, Libby, MT. 1 p.

Toweill, D.E. and J.W. Thomas. (eds.). 2002. North American elk: ecology and management. Smithsonian Institution Press. Washington, DC. 962 pp.

TRC Environmental Corporation. 1989. Air quality permit application for Noranda's Montanore Project. Submitted to the Montana Department of Health and Environmental Sciences.

TRC Environmental Corporation. 2006a. Application for air quality preconstruction permit (revised). Submitted to the KNF and the DEQ. p. 64 plus appendices.

TRC Environmental Corporation. 2006b. AQRV modeling analysis results. Submitted to the DEQ. p. 8 plus appendices.

U.S. Army Corps of Engineers and Environmental Protection Agency. 2007. U.S. Army Corps of Engineers Jurisdictional Determination Form Instructional Guidebook. May 30.

U.S. Army Corps of Engineers. 1982a. Engineering Manual EM-111-2-1902.

U.S. Army Corps of Engineers. 1982b. Process Design Manual for Land Treatment of Municipal Wastewater. EM 1110-1-501.

U.S. Army Corps of Engineers. 1993. Department of the Army Permit 199270047. On file with the Corps. pp. 28.

U.S. Army Corps of Engineers. 2002. Public Notice. Issue Date: May 10, 2002. Helena Regulatory Office. Omaha District.

U.S. Army Corps of Engineers. 2005. Guidance for Compensatory Mitigation and Mitigation Banking in the Omaha District. Omaha District. Available at: https://www.nwo.usace.army.mil/html/op-r/guidance-aug05.pdf.

U.S. Army Corps of Engineers. 2008. November 12, 2008 letter from Allan Steinle, Montana Program Manager to Eric Klepfer, Klepfer Mining Service LLC regarding preliminary jurisdictional determination of the Poorman Alternative site.

U.S. Census Bureau. 2004. Population Finder. Available at: <http://www.census.gov>.

U.S. Census Bureau. 2006a. State and County QuickFacts. Available at: <http://quickfacts.census.gov/qfd/states/30/30053.html>.

U.S. Census Bureau. 2006b. Selected Economic Characteristics. Available at: <http://www.census.gov/census2000/states/mt.html>.

U.S. Department of Agriculture (USDA). 1997. Departmental Regulation, Environmental Justice. Available at: <http://www.usda.gov/da/5600-2.pdf>.

U.S. Geological Survey (USGS). 1981. Mineral resources of the Cabinet Mountains Wilderness, Lincoln and Sanders counties, USGS Bulletin 1501.

U.S. Geological Survey (USGS). 1983. Elephant Peak and Howard Lake 7.5-minute quadrangles. Denver, CO.

U.S. Geological Survey (USGS). 2007. USGS Water Data for Montana. Available at: <http://waterdata.usgs.gov/MT/nwis>.

U.S. Geological Survey (USGS). 2008. Mineral commodity summaries 2008. pp. 199.

USDA Forest Service and Montana Department of Environmental Quality. 2001. Final Environmental Impact Statement, Rock Creek Project. p. 951 plus appendices.

USDA Forest Service and Natural Resources Conservation Service. 1995. Soil survey of Kootenai National Forest Area. Montana and Idaho. pp. 122.

USDA Forest Service, Montana Department of State Lands, Montana Department of Health and Environmental Sciences, and Montana Department of Natural Resources and Conservation. 1992. Final Environmental Impact Statement, Montanore Project. p. 471 plus appendices.

USDA Forest Service. 1974. The Visual Management System. Agricultural Handbook Number 462.

USDA Forest Service. 1987. Kootenai Forest Plan, Volumes 1 and 2. KNF, Northern Region. Missoula. MT. p. 660. The Kootenai Forest plan is Available at: <www.fs.fed.us/r1/kootenai/projects/planning/documents/forest_plan/87_plan>.

USDA Forest Service. 1988a. Cumulative effects analysis process for the Selkirk/Cabinet-Yaak Grizzly Bear Ecosystems. 32 pp.

USDA Forest Service. 1988b. Soil and Water Conservation Handbook, Forest Service Handbook 2509:22. R-1 Missoula, Montana/R-4 Ogden, Utah. p. 140.

USDA Forest Service. 1989. General Aquatic Wildlife System User Guide. Intermountain Region. Ogden, UT.

USDA Forest Service. 1990. ROS Primer and Field Guide. Available at: <http://www1.forest.gov.tw/lib/2005_US_Forum/1_ROS/ros_brochure_r6_rec_021_90.pdf>.

USDA Forest Service. 1991. Kootenai Supplement Number 85 to FSM 2432.22 Timber Management. Libby, MT.

USDA Forest Service. 1993. Montanore Project, Final Environmental Impact Statement, Record of Decision. KNF. Libby, MT. p. 22 plus appendices.

USDA Forest Service. 1995. Inland Native Fish Strategy Environmental Assessment Decision Notice and Finding of No Significant Impact. Intermountain, Northern and Pacific Northwest Regions. 17 pp. plus attachments.

USDA Forest Service. 1998a. Biological Opinion for the Effects to Bull Trout from Continued Implementation of Land and Resource Management Plans as Amended by the Interim Strategy for Managing Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana, and Portions of Nevada (INFS), and the Interim Strategy for Managing Anadromous Fish Producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH). USDA. Available at: <http://www.fs.fed.us/r6/fish/biological-opinions/980823_bt_bo/980823_BO_bull_trout-conv-wp-2000.doc>.

USDA Forest Service. 1998b. Northern Region Landbird Monitoring Project, Field Methods. Missoula, MT. 61 pp.

USDA Forest Service. 1999a. Roads analysis: informing decisions about managing the National Forest Transportation System. Misc. Rep. FS-643. Washington, DC. 222 p. Available at: <http://www.fs.fed.us/eng/road_mgt/01titlemain.pdf>.

USDA Forest Service. 1999b. Vegetation Response Unit characterizations and target landscape prescriptions. KNF. Libby, MT. p. 174. R. Gautreaux (tech. ed.). Available at: <http://www.fs.fed.us/r1/kootenai/projects/planning/documents/vru_doc/index.shtml>.

USDA Forest Service. 2000a. Wayup Mine/Fourth of July Road Access Record of Decision. KNF. February.

USDA Forest Service. 2000b. Wayup Mine/Fourth of July Road Access Final Environmental Impact Statement. KNF. January.

USDA Forest Service. 2000c. Screening Methodology for Calculating ANC Change to High Elevation Lakes, User's Guide. USDA Forest Service, Region 2.

USDA Forest Service. 2001. FSM 2000 – National Forest Resource Management Zero Code 2080 – Noxious Weed Management. USDA Forest Service, Region 1. Missoula, MT.

USDA Forest Service. 2002. Final Environmental Impact Statement, Forest Plan Amendments for Motorized Access Management Within the Selkirk and Cabinet-Yaak Grizzly Bear Recovery Zones for the Kootenai, Lolo, and Idaho Panhandle National Forests. March.

USDA Forest Service. 2003a. Record of Decision, Rock Creek Project. On file with the KNF. pp. 89 plus attachments.

USDA Forest Service. 2003b. Technical Report: Analysis of the Management Situation for Revision of the Kootenai and Idaho Panhandle Forest Plans. March 2003. 149 pp. This document is Available at: <www.fs.fed.us/kipz/documents/ams>.

USDA Forest Service. 2003c. Forest Plan Monitoring and Evaluation Report Fiscal Year 2002. KNF, Libby, MT. 64 pp. Available at: <www.fs.fed.us/r1/kootenai/projects/planning/documents/forest_plan/monitoring>.

USDA Forest Service. 2003d. Fisher Landscape Assessment. Ecological Analysis at the Watershed Scale (EAWS). KNF, Libby Ranger District. September.

USDA Forest Service. 2003e. Libby Ranger District Lynx Analysis Unit Status Report. March 24.

USDA Forest Service. 2004. Draft Environmental Impact Statement Northern Rockies Lynx Amendment National Forests in Montana, parts of Idaho, Wyoming and Utah Bureau of Land Management Units in Idaho and parts of Utah. USDA Forest Service, USDI Bureau of Land Management. Northern Region, Missoula, MT. 416 pp. Available at: <http://www.fs.fed.us/r1/planning/lynx.html>.

USDA Forest Service. 2005a. Habitat Survey Data Sheets 1997-2005. Libby Ranger District.

USDA Forest Service. 2005b. Bear Lakes Access Environmental Assessment. KNF.

USDA Forest Service. 2005c. Forest Plan Monitoring and Evaluation Report Fiscal Years 2003-2004. KNF, Libby, MT. 60 pp. Available at: <www.fs.fed.us/r1/kootenai/projects/planning/documents/forest_plan/monitoring>.

USDA Forest Service. 2005d. Monitoring selected conditions related to the Wilderness character: A National Framework. Fort Collins, CO. p. 38.

USDA Forest Service. 2006a. Draft Interim Ground-Water Resource Inventory and Monitoring Protocol, Level I Spring Ecosystem Inventory.

USDA Forest Service. 2006b. Draft Biological Assessment for Threatened, Endangered, and Proposed Species on the Montanore Mining Corporation Libby Adit – Evaluation Drilling Program. KNF, Libby Ranger District.

USDA Forest Service. 2006c. Spreadsheet - 1998-2004 Metric values for all KNF samples. Created by Mark Vinson.

USDA Forest Service. 2006d. Forest Plan Monitoring and Evaluation Report Fiscal Year 2005. KNF, Libby, MT. 22 pp. Available at: <www.fs.fed.us/r1/kootenai/projects/planning/documents/forest_plan/monitoring>.

USDA Forest Service. 2007a. Northern Rockies Lynx Management Direction Final Environmental Impact Statement and Record of Decision. National Forests in Montana, and parts of Idaho, Wyoming, and Utah, March. pp. 399 plus appendices. Available at: <http://www.fs.fed.us/r1/planning/lynx.html wildlife>.

USDA Forest Service. 2007b. Revised Plan of Operation Addendum for Arnold Bakie, Libby Creek Ventures. KNF, Libby Ranger District.

USDA Forest Service. 2007c. Employment and Labor Income Effects Proposed Montanore Mine Project, Lincoln County, MT.

USDA Forest Service. 2007d. Forest Plan Monitoring and Evaluation Report Fiscal Year 2006. KNF, Libby, MT. 28 pp. Available at: <www.fs.fed.us/r1/kootenai/projects/planning/documents/forest_plan/monitoring>.

USDA Forest Service. 2007e. Selkirk and Cabinet-Yaak Grizzly Bear Recovery Zones 2006 Annual Compliance Monitoring Summary Report. Prepared by Johnson, W. and D. Roberts. On file with the KNF. 9 pp.

USDA Forest Service. 2008a. Agency Seepage Analysis of Seepage from Cherry Creek Tailings Dam. pp 2. On file with the KNF.

USDA Forest Service. 2008b. Phase 3 Lake Water Chemistry Monitoring Absaroka Beartooth, Cabinet Mountains, and Selway Bitterroot Wilderness Areas 1994-2007. M.T. Story and J. Grenon, Gallatin National Forest, USDA Forest Service. p 15.

USDA Forest Service. 2008c. Air Resource Management Surface Water and Bulk Deposition Data Website. Available at: <http://www.fs.fed.us/waterdata/>.

USDA Natural Resources Conservation Service (USDA NRCS). 2008. The PLANTS Database Available at: http://plants.usda.gov>. Accessed: January 23). National Plant Data Center, Baton Rouge, LA 70874-4490.

U.S. Department of Agriculture (USDA). 1997a. Guide to USDA Programs for American Indians and Alaska Natives. Program Aid Number 1617. Available at: <http://www.usda.gov/news/pubs/indians/open.htm>.

U.S. Department of Agriculture (USDA). 1997b. Departmental Regulation on Environmental Justice. Available at: <http://www.nrcs.usda.gov/TECHNICAL/ECS/environment/envjust.html>.

USDI Fish and Wildlife Service (USFWS), National Marine Fisheries Service, Plum Creek Timber Company, and CH2M Hill. 2000. Final Environmental Impact Statement and Native Fish Habitat Conservation Plan – Proposed Permit for Taking of Federally Listed Native Fish Species on Plum Creek Timber Company, Inc. Lands. September.

USDI Fish and Wildlife Service (USFWS). 1978. Recovery plan for the eastern timber wolf. U.S. Gov. Printing Office, Washington, DC. 79 pp. *In*: Frederick, G.P. 1991. Effects of Forest Roads on Grizzly Bears, Elk, and Gray Wolves: A Literature Review. USDA Forest Service, KNF, 506 U.S. 2 West, Libby, MT. 53 pp.

USDI Fish and Wildlife Service (USFWS) 1987. Northern Rocky Mountain Wolf Recovery Plan. Denver, CO. 119 pp.

USDI Fish and Wildlife Service (USFWS). 1993. Grizzly bear recovery plan. Missoula, MT. 181 pp.

USDI Fish and Wildlife Service (USFWS). 1995. Endangered and Threatened Wildlife and Plants; Final Rule to Reclassify the Bald Eagle from Endangered to Threatened in all of the Lower 48 States. 50 CFR Part 17. *Federal Register*, Vol. 60, No. 133, July 12. pp. 35999-36010.

USDI Fish and Wildlife Service (USFWS). 1998 (revised 6/11/99). Draft: A Framework to Assist in Making Endangered Species Act Determination of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale. Adapted from the National Marine Fisheries Service, Coastal Salmon Conservation: Working guidance for comprehensive salmon restoration initiatives on the Pacific coast. September 1996.

USDI Fish and Wildlife Service (USFWS). 1999. Endangered and Threatened Wildlife and Plants; Proposed Rule to Remove the Bald Eagle in the Lower 48 States from the List of Endangered and Threatened Wildlife. 50 CFR Part 17. *Federal Register*, Vol. 64, No. 128. July 6. pp 36454-36464.

USDI Fish and Wildlife Service (USFWS). 2001. Concurrence letter from Mark R. Wilson, on maps of threatened and endangered species potential distribution on the KNF. 2 pp. (plus attachments). Montana Field Office, Helena, MT. Also cited as Wilson 2001. March 6.

USDI Fish and Wildlife Service (USFWS). 2002. Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. Portland, OR. Available at: <http://www.fws.gov/pacific/bulltrout/recovery.html>.

USDI Fish and Wildlife Service (USFWS). 2003a. Biological Opinion and Conference Opinion on the Effects to Grizzly Bear, Bull Trout, and Lynx from the Implementation of Proposed Actions Associated with Plans of Operation for the Sterling Mining Company Rock Creek Copper/Silver Mine. Montana Ecological Services Field Office. p. 123.

USDI Fish and Wildlife Service (USFWS). 2003b. Rock Creek Mine Biological Opinion: Endangered Species Act, Section 7 Consultation, Biological Opinion and Conference Opinion on the Effects to Grizzly Bear, Bull Trout, and Lynx from the Implementation of Proposed Actions Associated with Plans of Operation for the Sterling Mining Company Rock Creek Copper/Silver Mine. Kootenai National Forest, Mountain-Prairie Region. Accessed 10/3/2007. Available at: <http://www.fws.gov/mountain-prairie/endspp/rockcreek>.

USDI Fish and Wildlife Service (USFWS). 2003c. Endangered and Threatened Wildlife and Plants; notice of remanded determination of status for the contiguous United States distinct population segment of the Canada lynx; clarifications of findings; final rule. 50 CFR Part 17. *Federal Register* Vol. 68, No. 128. pp. 40076-40101.

USDI Fish and Wildlife Service (USFWS). 2005. Recovery outline for the contiguous United States distinct population segment of the Canada Lynx. Montana Ecological Services Field Office. Pp. 22.

USDI Fish and Wildlife Service (USFWS). 2006. Biological Opinion on the Effects to Grizzly Bears, Bull Trout, and Bull Trout Critical Habitat from the Implementation of Proposed Actions Associated with Plan of Operations for the Revett RC Resources Incorporated Rock Creek Copper/Silver Mine. Montana Ecological Services Field Office. p. 130.

USDI Fish and Wildlife Service (USFWS). 2007a. Supplement to the Biological Opinion on the Effects to Grizzly Bears, Bull Trout, and Bull Trout Critical Habitat from the Implementation of Proposed Actions Associated with Plan of Operations for the Revett RC Resources Incorporated Rock Creek Copper/Silver Mine. Montana Ecological Services Field Office. pp. 169.

USDI Fish and Wildlife Service (USFWS). 2007b. National Bald Eagle Management Guidelines. 23 pp.

USDI Fish and Wildlife Service (USFWS). 2007c. Biological Opinion on the Effects of the Northern Rocky Mountain Lynx Amendment on the Distinct Population Segment of Canada Lynx (*Lynx canadensis*) (Lynx) in the Contiguous United States. Montana Ecological Services Field Office. 95 pp.

USDI Fish and Wildlife Service (USFWS), Nez Perce Tribe, USDI National Park Service, and USDA Wildlife Services. 2001. Rocky Mountain Wolf Recovery 2000 Annual Report. T. Meier, (ed.). Ecological Services, Helena, MT. 35 pp.

USDI Fish and Wildlife Service (USFWS), Nez Perce Tribe, USDI National Park Service, and USDA Wildlife Services. 2002. Rocky Mountain Wolf Recovery 2001 Annual Report. T. Meier, (ed.). Ecological Services, Helena, MT. 43 pp.

USDI Fish and Wildlife Service (USFWS), Nez Perce Tribe, USDI National Park Service, and USDA Wildlife Services. 2003. Rocky Mountain Wolf Recovery 2002 Annual Report. T. Meier, (ed.). Ecological Services, Helena MT. 64 pp.

USDI Fish and Wildlife Service (USFWS), Nez Perce Tribe, USDI National Park Service, and USDA Wildlife Services. 2004. Rocky Mountain Wolf Recovery 2003 Annual Report. T. Meier, (ed.). Ecological Services, Helena MT. 65 pp.

USDI Fish and Wildlife Service (USFWS), Nez Perce Tribe, USDI National Park Service, and USDA Wildlife Services. 2005. Rocky Mountain Wolf Recovery 2004 Annual Report. D. Boyd, (ed.). Ecological Services, Helena MT. 72 pp.

USDI Fish and Wildlife Service (USFWS), Nez Perce Tribe, USDI National Park Service, Montana Fish, Wildlife and Parks, Idaho Department of Fish and Game, and USDA Wildlife Services. 2006. Rocky Mountain Wolf Recovery 2005 Annual Report. C. A. Sime and E. E. Bangs, (eds.). Ecological Services, Helena, MT. 130 pp.

USDI Fish and Wildlife Service (USFWS), Nez Perce Tribe, USDI National Park Service, Montana Fish, Wildlife and Parks, Idaho Department of Fish and Game, and USDA Wildlife Services. 2007. Rocky Mountain Wolf Recovery 2006 Annual Report. C. A. Sime and E. E. Bangs, (eds.). Ecological Services, Helena, MT. 235 pp.

USDI Fish and Wildlife Service (USFWS), Nez Perce Tribe, USDI National Park Service, Montana Fish, Wildlife and Parks, Blackfeet Nation, Confederated Salish and Kootenai Tribes, Idaho Department of Fish and Game, and USDA Wildlife Services. 2008. Rocky Mountain Wolf Recovery 2007 Interagency Annual Report. C.A. Sime and E. E. Bangs, (eds.). USFWS, Ecological Services, 585 Shepard Way, Helena, MT. 59601. 275pp.

Vinkey, R. 2003. An Evaluation of Fisher (*Martes pennanti*) Introductions in Montana. Missoula, MT: University of Montana. M.S. thesis, 97 pp.

Vinkey, R. M.K. Schwartz, K.S. McKelvey, K.R. Foresman, K.L. Pilgrim, B.J. Giddings, and E.C. LoFroth. 2006. When reintroductions are augmentations: the genetic legacy of fishers (*Martes pennanti*) in Montana. Journal of Mammalogy 87(2): 265-271.

Wakkinen, W. and W. Kasworm. 1997. Grizzly Bear and Road Density Relationships in the Selkirk and Cabinet-Yaak Recovery Zones. Idaho Department of Fish and Game (Bonners Ferry, ID) and USFWS. Libby, MT. 28 pp.

Wallace, J.B., J.W. Grubaugh, and M.R. Whiles. 1996. Biotic indices and stream ecosystem processes: results from an experimental study. Ecological Applications 6:140-151.

Warren, N. (tech. ed.) (USDA Forest Service). 1990. Old-growth habitats and associated wildlife species in the northern Rocky Mountains. USDA Forest Service, Missoula, MT. 47 pp.

Washington Water Power Company. 1996. Lower Clark Fork River Tributary Survey Final Report. Prepared for Cooperative Challenge Cost Share Project between Washington Water Power Company, USDA Forest Service, and Montana Fish, Wildlife, and Parks. Spokane, WA.

Waters, T.F. 1995. Sediment in Streams: Sources, Biological Effects, and Control. American Fisheries Society Monograph 7. Bethesda, MD.

Watershed Consulting, LLC, and Kline Environmental Research, LLC. 2005. Montanore Project: R1/R4 Stream Habitat Surveys. Submitted to the KNF and the DEQ. p. 14 plus appendix.

Watson, G. and T.W. Hillman. 1997. Factors affecting the distribution and abundance of bull trout: an investigation at hierarchical scales. North American Journal of Fisheries Management 17(2):237-252.

Weaver, J.L., P.C. Paquet, and L.F. Ruggiero. 1996. Resilience and conservation of large carnivores in the Rocky Mountains. Conservation Biology 10(4):963-976.

Weaver, T.M. and J.J. Fraley. 1991. Fisheries habitat and fish populations. Flathead basin forest practices, water quality and fisheries cooperative program. Flathead Basin Commission, Kalispell, MT.

Weaver, T.M. and J.J. Fraley. 1993. A method to measure the emergence success of western cutthroat trout fry from varying substrate composition in a natural stream channel. North American Journal of Fisheries Management 13:817-822.

Wegner, S. 2006a. Senior Hydrologist. KNF. Personal communication with Jennifer Lynch, Aquatic Biologist, Chadwick Ecological Consultants, Inc. January 31.

Wegner, S. 2006b. Senior Hydrologist. KNF. Personal communication with Michael Galloway, senior hydrogeologist, regarding elevation of springs. ERO Resources Corporation. January.

Wegner, S. 2006c. Senior Hydrologist. KNF. Personal communication with Barbara Galloway, senior hydrologist, regarding rain-on-snow events. ERO Resources Corporation. July.

Wegner, S. 2006d. Senior Hydrologist. KNF. Personal communication with Barbara Galloway, senior hydrologist, regarding KNF surface water data. ERO Resources Corporation. July.

Wegner, S. 2007. Senior Hydrologist. KNF. Personal communication with Barbara Galloway, senior hydrologist, regarding streamflow measurements. ERO Resources Corporation. September.

Wegner, S. 2008. Senior Hydrologist. KNF. Personal communication with Barbara Galloway, senior hydrologist, regarding Ramsey Lake. ERO Resources Corporation. January.

Werner, J.K., B.A. Maxell, P. Hendricks, and D. Flath. 2004. Amphibians and Reptiles of Montana. Mountain Press Publishing Company. Missoula, MT. pp. 262.

Westech Environmental Services, Inc. 2005a. Addendum to the wildlife baseline report, Montanore Project. Prepared for Mines Management Inc. Submitted to the KNF and the DEQ. November. p. 29 plus appendices.

Westech Environmental Services, Inc. 2005b. Noxious weed update 2005, Montanore Project. Submitted to the KNF and the DEQ. p. 6 plus appendix.

Westech Environmental Services, Inc. 2005c. Sensitive plant species assessment 2005, Montanore Project. Submitted to the KNF and the DEQ. p. 14 plus appendices.

Westech Environmental Services, Inc. 2005d. Vegetation update, Montanore Project. Submitted to the KNF and the DEQ. p. 40 plus appendices.

Westech Environmental Services, Inc. 2005e. Waters of the U.S. redelineation, Montanore Project. Submitted to the KNF and the DEQ. p. 24 plus appendices.

Western Economic Services, LLC. 2005. 2005 Hard Rock Mining Impact Plan for the Mines Management, Inc. Montanore Project. Submitted to the KNF and the DEQ. p. 48.

Western Economic Services, LLC. 2006. 2005 Socioeconomic report for the Mines Management Montanore Project. Submitted to the KNF and the DEQ. p. 166.

Western Resource Development Corporation. 1989a. Aquatic biology study, Montana Project 1990. *In* Amended application for a hard rock operating permit and amended plan of operations. Mines Management, Inc. 2005. Appendix D-1. p. 239 plus appendices.

Western Resource Development Corporation. 1989b. Baseline soils study, Montana Project 1989. *In* Amended application for a hard rock operating permit and amended plan of operations. Mines Management, Inc. 2005. Appendix F. p. 121 plus appendices.

Western Resource Development Corporation. 1989c. Addendum, baseline soils study, Montana Project 1989. *In* Amended application for a hard rock operating permit and amended plan of operations. Mines Management, Inc. 2005. Appendix F. p. 36.

Western Resource Development Corporation. 1989d. Baseline vegetation study, Montana Project 1989. *In* Amended application for a hard rock operating permit and amended plan of operations. Mines Management, Inc. 2005. Appendix E. p. 141 plus appendices.

Western Resource Development Corporation. 1989e. Addendum, baseline vegetation study, Montana Project 1989. *In* Amended application for a hard rock operating permit and amended plan of operations. Mines Management, Inc. 2005. Appendix E. p. 104.

Western Resource Development Corporation. 1989f. Wildlife baseline report, Montana Project, 1989. *In* Amended application for a hard rock operating permit and amended plan of operations. Lincoln and Sanders counties, MT. Prepared for Noranda Minerals Corporation. Mines Management, Inc. Appendix C. p. 175.

Western Technology and Engineering, Inc. 1991. Montanore Project, Aquatic macroinvertebrate monitoring study 1990. *In* Amended application for a hard rock operating permit and amended plan of operations. Mines Management, Inc. 2005. Appendix D-1. p. 48.

Western Technology and Engineering, Inc. 1992. Montanore Project, Aquatic biological monitoring 1991. *In* Amended application for a hard rock operating permit and amended plan of operations. Mines Management, Inc. 2005. Appendix D-2. p. 93.

Western Technology and Engineering, Inc. 1993. Montanore Project, Aquatic biological interim monitoring 1992. *In* Amended application for a hard rock operating permit and amended plan of operations. Mines Management, Inc. 2005. Appendix D-2. p. 102 plus appendices.

Western Technology and Engineering, Inc. 1994. Montanore Project, Continued interim aquatic biological monitoring 1993. *In* Amended application for a hard rock operating permit and amended plan of operations. Mines Management, Inc. 2005. Appendix D-3. p. 102 plus appendices.

Western Technology and Engineering, Inc. and Phycologic, Inc. 1995. Montanore Project, Continued interim aquatic biological monitoring 1994. *In* Amended application for a hard rock operating permit and amended plan of operations. Mines Management, Inc. 2005. Appendix D-3. p. 112 plus appendices.

Weydemeyer, W. and D. Weydemeyer. 1928. The woodpeckers of Lincoln County, MT. The Condor 30:339-346.

Whitaker, J.O., C.E. Maser, and L.E. Keller. 1977. Food habits of bats of western Oregon. Northwest Sci. 51:46-55.

Wiederholm, T. 1989. Responses of aquatic insects to environmental pollution. pp. 508-557. *In* V.H. Resh and D.M. Rosenberg (eds.). The Ecology of Aquatic Insects. Praeger Scientific. New York, NY.

Wilhm, J.L. 1970. Range of diversity indicies in benthic macroinvertebrate populations. Journal of Water Pollution Control Federation 42:R227-R234.

Williams, J. 2006. Biologist, Montana Fish, Wildlife, and Parks. Personal communication with K. Baud, Wildlife Biologist, ERO Resources Corporation. KNF Project Record, Montanore Project. February 10.

Williams, J. 2008. Biologist, Montana Fish, Wildlife, and Parks. Personal communication with K. Baud, Wildlife Biologist, ERO Resources Corporation. September 22.

Wilson, A.H. 1972. Research into the Determination of Pillar Size, Part 1—An Hypothesis Concerning Pillar Stability. The Mining Engineer 131(141):409-417.

Witmer, G.W., S.K. Martin, and R.D. Sayler. 1998. Forest carnivore conservation and management in the interior Columbia basin: Issues and environmental correlates. USDA Forest Service, Pacific NW Res. Station, Portland, OR. General Technical Report PNW-GTR-420. 51 pp.

Wittinger, T, W. Kasworm, W. Waakinen, T. Manley, B. Summerfield, L. Young and B. Ralphs. 2002 (unpublished). Grizzly bear distribution outside of recovery zones. USDA Forest Service, Region 1, Missoula, MT. pp 2.

Woodward-Clyde Consultants, Inc. 1989a. Baseline air quality and meteorological studies, Montana Project. *In* Amended application for a hard rock operating permit and amended plan of operations. Mines Management, Inc. 2005. Appendix A. pp. 18.

Woodward-Clyde Consultants, Inc. 1989b. Air quality and meteorological baseline data collection, Montana Project. *In* Amended application for a hard rock operating permit and amended plan of operations. Mines Management, Inc. 2005. Appendix A. pp. 17.

Woodward-Clyde Consultants, Inc. 1989c. Baseline noise studies, Montana Project. *In* Amended application for a hard rock operating permit and amended plan of operations. Mines Management, Inc. 2005. Appendix H. pp. 11.

Woodward-Clyde Consultants, Inc. 1989d. Visual Resource Baseline Study, Montana Project. *In* Amended application for a hard rock operating permit and amended plan of operations. Mines Management, Inc. 2005. Appendix G. pp. 30.

Wright, V. 1996. Multiscale analysis of flammulated owl habitat use: owl distribution, habitat management, and conservation. M.S. thesis. University of Montana, Missoula, MT. 91 pp.

Wright, V., S.J. Hejl, and R.L. Hutto. 1997. Conservation implications of a multi-scale study of flammulated owls (*Otus flammeolus*) habitat use in the northern Rocky Mountains, USA. pp. 506-516. *In* J.R. Duncan, D.H. Johnson, and T.H. Nicholls, editors. Biology and Conservation of owls of the Northern Hemisphere. USDA Forest Service General Technical Report NC-190.

114 copies of this public document were published at an estimated cost of $24.03 per copy, for a total cost of $2,739.42.